73 Amateur Radio Today

Including Ham Radio Fun!

JUNE 1996
ISSUE #429
USA $3.95
CANADA $4.95
International Edition

Did NASA Moon America?...

See page 88

Yukihiro, Son of JQ3JUG

Reviews: MFJ 9406 (6m SSB)
JPS ANC-4 (de-noiser)
GM-20 QRP Xcvr
Carolina Bug Katcher

Build: 2m Diamond ant.
NiCd Nurse
Henry Meter
Deluxe Foxhunting ant.

JRC

JST-245

160-10 Meters PLUS 6 Meter Transceiver

Fifteen reasons why your next HF transceiver should be a JST-245. . .

1 All-Mode Operation (SSB,CW,AM,AFSK,FM) on all HF amateur bands and 6 meters. JST-145, same as JST-245 but without 6 meters and built-in antenna tuner.

★ JST-145 COMING SOON ★

2 MOSFET POWER AMPLIFIER • Final PA utilizes RF MOSFETs to achieve low distortion and high durability. Rated output is 10 to 150 watts on all bands including 6 meters.

3 AUTOMATIC ANTENNA TUNER • Auto tuner included as standard equipment. Tuner settings are automatically stored in memory for fast QSY.

4 MULTIPLE ANTENNA SELECTION • Three antenna connections are user selectable from front panel. Antenna selection can be stored in memory.

5 GENERAL COVERAGE RECEIVER • 100 kHz-30 MHz, plus 48-54 MHz receiver. Electronically tuned front-end filtering, quad-FET mixer and quadruple conversion system (triple conversion for FM) results in excellent dynamic range (>100dB) and 3rd order ICP of +20dBm.

6 IF BANDWIDTH FLEXIBILITY • Standard 2.4 kHz filter can be narrowed continuously to 800 Hz with variable Bandwidth Control (BWC). Narrow SSB and CW filters for 2nd and 3rd IF optional.

7 QRM SUPPRESSION • Other interference rejection features include Passband Shift (PBS), dual noise blanker, 3-step RF attenuation, IF notch filter, selectable AGC and all-mode squelch.

8 NOTCH TRACKING • Once tuned, the IF notch filter will track the offending heterodyne (±10 Khz) if the VFO frequency is changed.

9 DDS PHASE LOCK LOOP SYSTEM • A single-crystal Direct Digital Synthesis system is utilized for very low phase noise.

10 CW FEATURES • Full break-in operation, variable CW pitch. built in electronic keyer up to 60 wpm.

11 DUAL VFOs • Two separate VFOs for split-frequency operation. Memory registers store most recent VFO frequency, mode, bandwidth and other important parameters for each band.

12 200 MEMORIES • Memory capacity of 200 channels, each of which store frequency, mode, AGC and bandwidth.

13 COMPUTER INTERFACE • Built-in RS-232C interface for advanced computer applications.

14 ERGONOMIC LAYOUT • Front panel features easy to read color LCD display and thoughtful placement of controls for ease of operation.

15 HEAVY-DUTY POWER SUPPLY • Built-in switching power supply with "silent" cooling system designed for continuous transmission at maximim output.

JRC *Japan Radio Co., Ltd.*

430 Park Ave., 2nd Floor New York, NY 10022 Phone: (212) 355-1180 Fax: (212) 319-5227

CIRCLE 159 ON READER SERVICE CARD

Corner Beam?

Big Forward Gain
Wide Backward Rejection
Exceptional Bandwidth
Compact Size

Your antenna makes all the difference at VHF and UHF—It determines transmitting range. It sets the limit for weak signal reception. And it decides what interference you'll hear & create.

An omnidirectional antenna radiates uniformly in all direction, and it also hears noise and interference from every direction.

A directional antenna not only sends your signal where you want, it hears the signal it's pointed at, rejecting others.

Gain really counts when you have to reach out across large distances to make contact. It also lets you operate with minimal power and cuts the interference you inflict on other stations.

Directionality is desirable in high activity locations. A clean sharp pattern without sidelobes or spikes reaches past the noise and interference to get the message through. Wide rear rejection lets you null out strong nearby signals to reduce interference.

CornerBeam vs. Yagi

When you want to contol your signal, think CornerBeam, not yagi. Take a look at what CornerBeam will do:

- •10 dB gain vs. dipole
- •40 dB Front-to-Back
- •60 degree Half-power Beamwidth
- •SWR <1.1:1 across the band
- •No dimension over 4 ft
- •Mounts directly to mast or tower
- •No need for offset or side mount for vertical polarization
- •Vertical or horizontal polarization
- •weighs only 10 pounds

Make the comparison with a yagi. A yagi with the same gain would have a boom 10 feet long. And yagi bandwidth would beless than half. Unlike a yagi, CornerBeam's pattern has no unwanted spikes or bustles to the side or behind.

Symetrical Pattern

CornerBeam's gamma match is engineered to be in-line rather than displaced from the element axis. The result is a distortion-free measured pattern that is precisely equal on each side of the antenna center line.

Bandwidth Counts

With its exceptional bandwidth, your CornerBeam can be put to work right out of the box without special tweaking. It can serve you now when you're working repeaters with an FM handheld, and later when you go after small signal DX at 144.05 or set out to work satellites.

CornerBeam can still be your beam when you join MARS at 143/148 MHz, team up with the Civil Air Patrol to locate downed aircraft at 154 MHz.

Scanning Too?

CornerBeam's directionality and gain extend your monitoring range on public service, marine, and aircraft frequencies.

CornerBeam for Repeaters

If your repeater shares a frequency with another, the deep wide null toward the rear could keep your signal out of the neighboring repeater's receiver and turn a deaf ear to its signal. A pair of CornerBeams can be combined to privide special radiation footprints. A CornerBeam aimed at an area your repeater hears poorly could improve service where incoming signals from HTs are presently too weak. CornerBeam makes it possible to increase repeater density while reducing interference.■

Corner Beam Models

Band	Max Dim	WindLd	Price
2 meters	4 ft	<2 sqft	$145
220 MHz	4 ft	<1 sqft	$145
70 cm	3 ft	<1 sqft	$115
Dual 146/435	4 ft	<3 sqft	$165

Construction: Aircraft aluminum. Booms are square. Elements are solid rod. Stainless hardware included for tower and mast mounting accepts up to 1.5" dia. mast and may be rotated for vertical or horizontal polarization. Connector is SO-239 for VHF, N female for UHF. Dual-Band antenna has separate driven elements, both with N connector.

Dimensions given in table are for reflector booms and reflector elements.

Options: Commercial Frequency $45.

Duplexer: Add $80 for VHF/UHF Duplexer and cabling for single coax feed of Dualband 146/435 Corner.

Shipping: UPS ground to continental USA ($11 S&H). Air Parcel Post to HI, AK, & Posessions ($14 P&H). Canada ($16 P&H). Allow 2 weeks for delivery.

Can You Find theTiger'sTail?

If your eyes are sharp you can spot the **TigerTail**™ in the photo above. It puts extra growl into the signal from the Hand Transceiver it's attached to.

TigerTail™ improves SWR, lowers radiation angle, and extends range. You can use low power and save your battery pack, but still have a big signal.

Better than an amplifier, it improves reception too. **TigerTail**™ does all this by simply slipping under your flex antenna and just hanging down. It doesn't stick up or out or get in the way. It's the simplest way to boost your signal.

☐ **Yes, I want Performance in My Corner!**

___Send my CornerBeam: __2m, __220MHz, __70 cm, __Dual 146/435.
___Options: __DualBand Duplexer, __Commercial/Marine Frequency:_____
___Send my TigerTail. (1 for $7.95, 2 for $15, 3 for $21. Specify band.)

☐ **Yes, I circled the TigerTail! Knock $5 off my order.**

Name_____Amt. Enclosed_____
Call_____ Phone_____
Street_____ Unit_____
City_____ State_____Zip_____

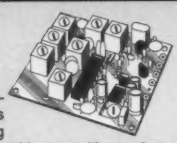
AntennasWest
Box 50062-S Provo UT 84605

InfoPak $1

Order Hotline **800 926 7373**

CIRCLE 57 ON READER SERVICE CARD

WWV RECEIVER



NEW

Get time & frequency checks without buying multiband hf rcvr. Very sensitive and selective xtal controlled superhet, dedicated to listening to WWV on 10.000 MHz. Performance rivals the most expensive receivers. ..... **only $59 kit, $99 w/t.**

LOW NOISE RECEIVER PREAMPS

LNG-(*)

still only $59
wired&tested

FEATURES:

- **Very low noise:** 0.7dB nf vhf, 0.8dB uhf
- **High gain:** 13-20dB (depends on freq)
- **Wide dynamic range** - resist overload
- **Stable:** dual-gate GAS FET

**Specify tuning range: 26-30, 46-56, 137-139, 139-152, 152-172, 210-230, 400-470, 800-960 MHz.*

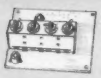
LNW-(*) MINIATURE PREAMP

still only $29 kit, $44 wired&tested

- **Low-cost** MOSFET preamp.
- **Small size.** Only 5/8"W x 1-5/8"L x ¾"H.
- Nf 1.2dB vhf, 1.5dB uhf.
- Solder terminals for coax & pwr connect.

**Specify tuning range: 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, 400-500 MHz.*

HELICAL RESONATORS



Helical resonator filters may **reduce your intermod & cross-band interference.**

MODEL HRF- (*), *$59 vhf, $99 uhf.*

**Specify tuning range: 136-140, 142-150, 150-162, 162-174, 213-233, 420-470.*

RECEIVING CONVERTERS

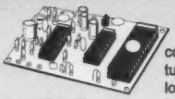
Low noise converters to receive vhf & uhf bands on a 10M receiver.

- Input ranges avail: 50-52, 136-138, 144-146, 145-147, 146-148, 220-222, 222-224 MHz, 432-434, 435-437, 435.5-437.5, and 439.25 (atv conv. to chan 3).
- **Kit less case *$49*, kit w/case & BNC jacks $79, w&t in case $99.**

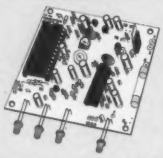
TRANSMITTING CONVERTERS

XV2 for vhf and XV4 for uhf. Models to convert 10M ssb, cw, fm, etc. to 2M, 432, 435, and atv. 1W output. **Kit only $89 (vhf), $99 (uhf).** *PA's up to 45W available.*

REPEATER CONTROLLERS



NEW **CWID-2.** Eprom-controlled, miniature, easy to build, low power CMOS, (specify call) ..... **only $54 kit, $79 w/t**

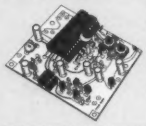


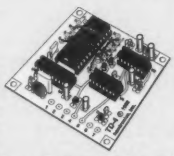
COR-6. COR & Real Voice ID on one board. Digital ic records up to 20 seconds of your voice. Can record multiple id messages. Tail and time-out timers, courtesy beep, solid-state relay to key transmitter. .....**kit $99, w&t $149**

COR-3. COR, timers, court.beep .... **kit $49**
CWID. Diode programmable ..... **kit $59**
COR-4. Complete COR and CWID all on one board. CMOS logic for low power consumption. EPROM programmed; (specify call) .....**kit $99, w&t $149**

ACCESSORIES

DVR-1 DIGITAL VOICE RECORDER. Records up to 20 sec. of your voice with built-in mic. or external mic. Terrific as voice ID'er for repeaters or fox hunt xmtr, contest caller, radio notepad, etc. Extensive manual tells how to use multiple messages adapt to many applications. .....**kit $59, w&t $99**





TD-4 SELECTIVE CALLING MODULE. Versatile dtmf controller with 1 latching output. **Mutes speaker until someone calls** by sending your 4-digit tt code. Or use it with a **long tt zero** digit to alert anyone in club for emergencies. Also may be used to **control autopatch or other device**, like TD-2 except only one output. .....**kit $49, w&t $79**

TD-3 CTCSS DECODER/ENCODER. Prevents access to repeater or receiver unless proper tone is present. Tone output for transmitters, too. ..... **kit $29, w/t $59**

AUTOPATCHES

AP-3 REPEATER AUTOPATCH. Reverse patch and phone line remote control. .....**kit $89, wired & tested $139**

AP-2 SIMPLEX AUTOPATCH Timing Board. Use with above for simplex operation using a transceiver. ..... **kit $39**

TD-2 DTMF DECODER/CONTROLLER. 16 digits, jumper-programmable, toll-call restrictor. Can turn 5 functions on/off. .....**kit $79, wired & tested $129**

DATA MODEMS

MO-202 FSK DATA MODULATOR & DE-202 DEMODULATOR. Run up to 1200 baud digital signals through any fm transmitter & receiver .....**kits $49, w&t $79**

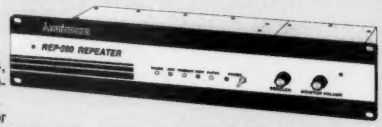
9600 BAUD DIGITAL RF LINKS. Call for info on low-cost packet networking system: MO-96 Modem and special versions of our 144, 220, or 450 MHz fm xmtrs and rcvrs. Use directly with most TNC's. Fast, diode-switched PA's output 15 or 50W.

You get more features for your dollar with our

REP-200 REPEATER

A fully microprocessor-controlled repeater with autopatch and many versatile dtmf control features at less than you might pay for a bare-bones repeater or controller alone!

Kit still only $1095
w&t still only $1295
50 & 900 MHz bands slightly higher



- Available for the 50-54, 143-174, 213-233, 420-475, 902-928 MHz bands.
- **FCC type accepted** for commercial service in150 & 450 bands. *(Request catalog for details.)*

REP-200T Voice Message Repeater. As above, except includes Digital Voice Recorder. Allows message up to 20 sec. to be **remotely recorded off the air.** Play back at user request by DTMF command, or as a periodical voice id, or both. **Great for making club announcements!**.....**adds only $100!**

REP-200C Economy Repeater. Uses COR-6 Controller (no DTMF control or autopatch). Features **real-voice ID.** .....**Kit only $795, w&t $1195**

REP-200N Repeater. Want to use your own controller? No problem! We'll make you a repeater with rf modules only. ..... **Kit only $695, w&t $995**

XMTRS & RCVRS FOR REPEATERS, AUDIO & DIGITAL LINKS, TELEMETRY, ETC.

Also available in rf-tight enclosures, and with data modems.

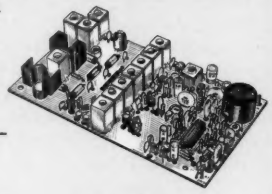
FM EXCITERS: 2W continuous duty.
FCC type accepted for com'l bands.

- **TA51**: 50-54, 143-174, or 213-233MHz.
- **TA451**: 420-475 MHz . *New low price!*

Either model: .....**kit $99, w/t $169.**

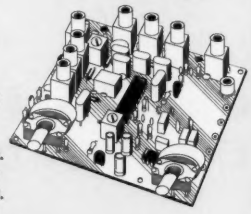
- **TA901**: 902-928 MHz, (0.5W out);

New low price! ..... **w/t $199.**



VHF & UHF AMPLIFIERS.
For fm, ssb, atv. Output levels from 10W to 100W. Models **starting at $99.**

FM RECEIVERS:



NEW **R100 FM RECEIVERS** for 46-54, 72-76, 140-175, or 216-225 MHz. **Very sensitive** – 0.15uV, **exceptional selectivity** – both crystal & ceramic if filters for >100dB at ±12kHz (best available anywhere), **flutter-proof** squelch. .....*New low price!* **kit $129, w/t $189.**

- **R451 FM RCVR,** for 420-475 MHz. Similar to above. *New low price!* **kit $129, w/t $189.**
- **R901 FM RCVR,** for 902-928MHz. Triple-conversion. *New low price*....**$159, w/t $219.**

NEW R150 MONITOR RCVR for 143-164 or 216-225 MHz. 4-channels. Great for monitoring repeaters, amateur calling frequencies, packet radio, commercial two-way radio, police/fire frequencies, or weather forecasts. **Good starter kit,** easy to assemble and align.....**kit only $99, w/t $189.**

- R120 AIRCRAFT RCVR for 110-136 MHz .....**kit only $99, w/t $219.**

WEATHER SATELLITE RECEIVER

R139 Is The Affordable WeSat Rcvr!

NEW Join the growing ranks of amateurs who get striking images directly from the weather satellites! We used our 30+ years of experience in designing high-quality vhf receivers to bring you a new enhanced version of our long-popular WeSat receivers. The new R139 is a very sensitive wideband fm receiver optimized for amateur reception of NOAA APT and Russian Meteor weather facsimile images on the 137 MHz band. Use with any popular demodulator and software. Covers all five popular satellite channels. Scanner circuit and recorder control allow you to automatically search for and tape signals as satellites pass overhead, even while away from home.

- **R139 Receiver Kit less case** **$159**
- **R139 Receiver Kit with case and 12Vdc power adapter**.....**$189**
- **R139 Receiver Wired/tested in case with 12Vdc power adapter** **$239**

- Buy at low, factory-direct net prices and save!
- For complete info. call or write for free catalog. *(Send $2 for overseas air mail.)*
- Order by mail, fax, or phone (9-12 AM, 1-5 PM eastern time).
- Min. $5 S&H charge for first pound plus add't weight & insurance.
- Use VISA, Mastercard, Discover, check, or UPS C.O.D.

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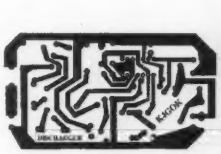
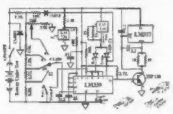
DEPARTMENTS



REVIEWS



HAM RADIO FUN SECTION

On the cover: QSL Card Contest entry from JQ3JUG Tadatoshi Sakai of Shiga 523 Japan featured his attractive son , Yukihiro, hamming it up. Toshi, this is your "prize" cover photo. The 73 Team hopes you are pleased.

Feedback: Any circuit works better with feedback, so please take the time to report on how much you like, hate, or don't care one way or the other about the articles and columns in this issue. G = great!, O = okay, and U = ugh. The G's and O's will be continued. Enough U's and it's Silent Keysville. Hey, this is *your* communications medium, so don't just sit there scratching your...er...head. FYI: Feedback "number" is usually the page number on which the article or column starts.

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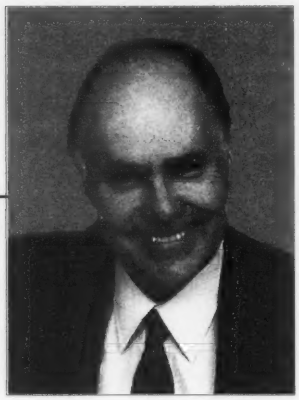
Contract: Even the most cursory glance at this text is sufficient to bind you, morally and legally, to take a kid (or kids) along on Field Day, get 'em fired up on amateur radio, and then help 'em get started toward a license. You'll feel good about yourself and our legal cousel won't have to hassle you.

NEVER SAY DIE

Wayne Green W2NSD/1



Elect a Ham

Last month I proposed the first step toward the solution of a lot of our problems; that every ham club in the country make a major effort to get a local ham elected to their state legislature. We desperately need hams in high places to protect us. And not only will a bunch of hams in the state legislatures give us one heck of a louder voice with our states, but also with the Feds.

With the FCC (and Congress) wising up to how much money they can take in selling or leasing the spectrum to commercial users, they're looking for more to sell, and guess which group has the largest hunk of relatively unused microwave frequencies? We either start building some political clout or we'll be blown away.

We need state clout to stop the growing number of antenna-limiting laws and ordinances. But most of all, we need it to get our schools to start teaching electronics, communications and computers. This will get us more hams and help make it so America can compete better in the information age—the 21st century.

I was hoping the Dayton HamVention would allow me give a talk on this, but the ARRL apparently has them under such tight control that this wasn't possible, even considering the importance of the message.

As you read my editorial this month I think you'll see many opportunities where ham legislators could make a difference in education, health care, government, and so on.

If you have any say with the organizers of a hamfest or convention, and they're not totally controlled by the ARRL, maybe you can get me on the speaker's list. I'm not charging anything beyond the costs for Sherry and me being there, which is what any speaker normally gets covered. However, between demands for keynote talks at education, music, and science conferences, my available time is limited.

Your Government at Work

Last year one of those TV shows devoted to the weird did a show interviewing farmers and their children who were involved with that alleged 1947 UFO crash in New Mexico. They sure made a good case for the reality of a crashed UFO and its dead occupants being covered up by the government. It definitely was enough to cause any intelligent person to shake off the bindings of "conventional wisdom" and start looking for more information. Or should that be called "conventional ignorance?"

Of course, having always been interested in the UFO phenomenon, I've done a lot of homework. I've read dozens of books over the last 50 years or so, some very thoroughly researched, others a waste of time. I think I mentioned that back in 1963. Jay Stanton (darn, I forget his call!), a writer friend who was a total UFO skeptic, set off to expose the whole UFO business as bunk. About two years later, no longer a skeptic, his book telling about his conversion was published. He cited some most convincing cases.

I've read enough books, talked with enough people who have had personal experiences, and had enough experiences of my own to know that something real is happening. I also know from several incidents that our beloved government is up to here in a cover-up. Yeah, I know, the old government cover-up baloney.

Well, if I hadn't had a first-hand inside experience with the cover-up in the Amelia Earhart case, which is still being covered up, I might be less easily convinced.

Then, a few days ago, there was another TV weirdo show on the New Mexico UFO crash. This program interviewed the children of some of the Air Force people who were involved. They, like the farmers, had seen the ETs. And their parents, like the farmers, had been threatened by government agents to keep quiet. Or else. Again, their story was most compelling.

But a federal agency wouldn't threaten private citizens, would they? Well, they did *me*. One federal agency got me into a room and explained that if I ever wrote or even published anything about that agency again they would put me in prison and guaranteed I'd never get out. No, I have never written about them again. And I won't, except in my memoirs, where I will have a whole lot of interesting things to write about. But unless you start paying attention to nutrition, the chances are good I'm going to outlive you.

Green's Rocker

A book came a couple days ago from a reader who wanted to swap it for copies of some of my books. This one sure got my attention. I was busy trying to find out more about dowsing from a couple of new books I'd just bought, but this one made me put everything else down.

My first reaction was probably what yours will be. It's *NASA Mooned America!*, by René, 196p, 1994. The ridiculous claim is that the Apollo missions to the moon never actually happened. Oh, Lordy, give me a break! What is this, some Flat Earth Society-type crappola? However, not being completely controlled by what I have been conditioned to believe, I read on. René has done a masterful job of destroying what little faith I had left in NASA. He shows evidence that many of their photographs of the moon missions are clearly bogus; he proves beyond a reasonable doubt that nobody can survive in space beyond the protection of the Van Allen Belt; and so on. By the time he's through, there's just no doubt that our government has produced a $40 billion space opera for us.

Yes, of course, Wayne has gone off his rocker with this one. Sure. Okay, smarty, what's the temperature in space? Hot? Cold? We all know it's awfully cold, right? The fact is, when the sun is shining on anything it gets blistering hot. The surface of the moon is 243°F in the sun and -279°F for the two weeks of night. Our astronauts were just there in the daylight, so they were dealing with an environment that was around 250°, with nowhere near enough power to run the cooling system needed to deal with that. René goes into every aspect of the inability of any living thing to survive the solar flares that occurred during the missions with the little shielding used, the temperatures involved in space and on the moon. The astronauts reeported that the LEM blasted a deep crater in landing on the moon. Why has not one NASA photo of the LEM on the moon ever shown a hint of this crater? They do show undisturbed dirt, complete with footprints (more about *that* impossibility later).

There are endless holes in the NASA production. Wait'll you see the not quite hidden power cords in some photos supposedly taken on the moon. Then there's one photo in the book of Aldrin and Armstrong saluting the flag, where they claim the sun is at about 13°, but Aldrin's photo was taken when the sun was at 26.4° and Armstrong's was taken with the sun at 34.9°, if one goes by the shadows they

Continued on page 6

ASTRON CORPORATION
9 Autry
Irvine, CA 92718
(714) 458-7277 • FAX (714) 458-0826

ASTRON POWER SUPPLIES

• HEAVY DUTY • HIGH QUALITY • RUGGED • RELIABLE •

MODEL VS-50M

SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output
- CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-3A, RS-4A, RS-5A, RS-4L, RS-5L
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD except for RS-3A
- ONE YEAR WARRANTY • MADE IN U.S.A.

PERFORMANCE SPECIFICATIONS

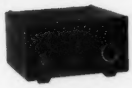
- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

SL SERIES

- LOW PROFILE POWER SUPPLY

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
SL-11A	•	•	7	11	2⅝ × 7⅞ × 9¾	12
SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅞ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

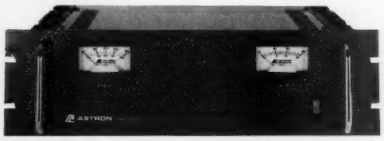
RS-L SERIES



- POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-4L	3	4	3½ × 6⅛ × 7¼	6
RS-5L	4	5	3½ × 6⅛ × 7¼	7

RM SERIES



MODEL RM-35M

- 19" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

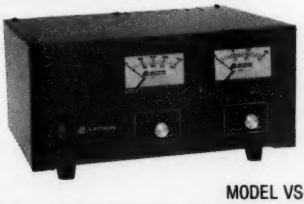
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46
RS-70A	•		57	70	6 × 13¾ × 12⅛	48

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46
RS-70M	57	70	6 × 13¾ × 12⅛	48

VS-M AND VRM-M SERIES



MODEL VS-35M

- Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
VS-70M	67	34	16	70	6 x 13¾ x 12⅛	48
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

- Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18
SL-11S	•	•	7	11	2¾ x 7⅝ x 9¾	12

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

Number 6 on your Feedback card

LETTERS

From the Ham Shack

Matt Paulonis KA2OOX. Uncle Wayne, after being out of ham radio for a number of years, I recently decided to get back into the action. I have to give a special thanks to Bob Chamberlain N2KBC, of the Crystal Radio Club, for his encouragement. I walked into the VE examinations at WECA's hamfest at Yonkers Raceway, intending to sit for a Tech Plus License, but due to Bob's persistence, I walked out with a General! I guess I didn't know all that the knowledge was still up there. My first few hours of returning to amateur radio were looking good. I had yet to run into the type of ham you criticize in your editorials. Later that evening, after borrowing a 2m rig from my friend Ron Masters KO2L, I thought I would get a feel for my newly earned privileges. What better method is there to learn about the local scene than on one of the local repeaters? The radio I was using didn't have PL codes on it, so I was limited to open repeaters. On my drive back into Manhattan from my parents' house on Long Island I tried to reach a couple of repeaters, but could only raise one in Mineola. I announced "KA2OOX/AG listening" a few times on the chance that I could catch someone tuning around. As I was nearing the city limits and about to give up, I finally got a reply. I was excited at first, but then heard what he had to say. I don't remember his call, but he said that he was a part owner of the repeater, and that my announcing myself seven times was absolutely unnecessary. I wondered why, if he had heard me the whole time, and had understood that the ".../AG" at the end of my callsign meant that I was new at this, that he didn't he say, "hello," or something simple like "welcome," or even explain the rules governing "his" repeater. Maybe I was too optimistic to believe that you are wrong and that the majority of hams out there are friendly and willing to help. Now, Wayne, I can say that I can relate to your stories about "closed" or "private" repeaters. So ended my first day as a General. *(That's what I've been running into all around the country! Golly, I'm old enough to remember when amateur radio was considered a fraternity and friendliness was the rule, not the exception. You know, I don't recall seeing one blessed word about this problem in any of the stack of club newsletters I get every month... Wayne.)*

David O'Neil, Greenacres FL. Wayne, you started my publishing career with an article you printed in *Microcomputing* in June of '80. It was about the BASIC physics programs that I use in my class. I had a brandnew shiny SWTPC 6800 computer (kit) loaded with 16K RAM! Well, you let the genie out. I'm on the Internet now, and you are the first person I'm notifying about the address. I also subscribe to *Cold Fusion*, but the high-school engineering-and-science club I sponsor decided we wouldn't try that yet. We have done a one-person dry pedal submarine, ham TV, a TV-eye model car, a TV-eye rocket, a 10-gallon 3-tier beer microbrewery, a 3-axis flight simulation cockpit, and two radio-control lawn mowers. We designed a circuit that uses a TV camera and radio control to keep an R/C car with a light on it going in a straight line automatically. I hope you'll find the time to check us out at: http://www.webeom.com/sknkwrks/ *(Thanks Dave, for the note. I'll bet some of our teacher readers will be checking out your page. Meanwhile tsks and tuts for not getting the club to try a cold fusion project. They could make international fame! And, at this early stage of the game, maybe even get some patents. The world leader, as far as we know, is right over there in Sarasota... Wayne)*

Bill Parker W8DMR. My April article on debunking some myths about antennas, feedlines, and SWR calls for some clarification. Walt Maxwell W2DU has written with regard to vacuum-tube amplifiers, "Whatever the conditions of mismatch at the load end of a transmission line, a matching network properly adjusted to obtain a conjugate match at the line input reflects 100% of the reflected power." No damage occurs to the amplifier. Cecil Moore K67BK wrote to say with regard to solid-state amplifiers, "A reflected voltage wave, due to feeding a long unterminated transmission line, is in phase with the generated voltage." Due to excessive voltage, the solid-state amplifier will fail. Damage will occur. Both Walt and Cecil are correct. A vacuum-tube amplifier with a conjugate match system responds one way; a solid-state fixed 50 ohm output system responds another way. Comparing the two different types of amplifiers should have been included. Yes, even the debunker needs debunking occasionally. See how myths get started? It's easy.

Frank Rumph KD4DZI. Wayne, in the December issue there was an article, "Nostalgia for the Future," which called for 2000 ohm earphones. Since they're hard to find, I solved the problem by putting two 1000 ohm Radio Shack™ output transformers (#273-1380) in series and feeding the two 8 ohm outputs to the low impedance left and right stereo earphones. 73

NEVER SAY DIE

Continued from page 4

cast. Worse, the shadows are in two different directions, and the flag casts no shadow at all. The angles of the sun were calculated by the lengths of the shadows compared to the height of the men. The sun moves about 10° a day, so Aldrin's photo would have had to be taken a day after they claimed, and Armstrong's a day later, all followed by some computer trickery to combine them.

Or was all of this done in a secret Nevada CIA base?

René provides a book full of proof that the whole moon deal was a fake put together by NASA and the CIA. It's a very well-written and researched book. It reduces our Right Stuff heroes to mere actors who have gone along with a Hollywood-type production. And those who caused any problems were killed! Did the "accidents" which killed 11 astronauts in 1967 raise any questions in your mind?

Illusions

It's difficult for me to get used to the real world. It sure isn't anything like I was taught in school, or anything my parents led me to believe. The more I learn, the less I have to believe in. Politics is crooked clear through, with money, via lobbies, firmly in control. The medical industry is just as crooked, protecting its $1 trillion business with the cooperation of the government. Our legal system is seriously corrupt, as is our educational industry, again with the complicity of the government. Our academic system is corrupt, again in bed with our government. Should I mention our tobacco industry? And liquor industry? Our public water supplies, packed with chlorine and fluorides? Oh yes, our dental industry, with amalgams and root canals. Our food industry, providing us with hormones, pesticides, antibiotics, and de-mineralized produce.

So I suppose I am pretty dumb, or at least naïve, to be surprised to read an exposé showing NASA to be siphoning off billions to produce blockbuster entertainment epics, hand in hand with the CIA.

The worst part is that, even with our government and, as far as I know, every major industry, thoroughly corrupt, we seem to have the best country in the world. Maybe I should just shut up and go along to get along. Maybe I should go back to grumbling about the bad language, rudeness, and endless brain-free contacts on our ham bands. And fan the flames between no-coders and old-timers. The CW and phone ops. And any other ham schisms.

Say, those confounded packeteers aren't going to screw around with the Internet, are they?

Heck, if you get to know many of the ARRL directors beyond the thoroughly whitewashed meeting reports in *QST*, you'll find out in what contempt they hold the members. That really disillusioned me when I got on the inside and got to

Continued on page 9

ORDER NOW 1-800 4 HOBBY KITS

FANTASTIC FM TRANSCEIVERS

- 2 Meters
- 223 MHz
- 440 MHz
- 6 Meters

Ramsey breaks the price barrier on FM rigs! The FX is ideal for shack, portable or mobile. The wide frequency coverage and programmable repeater splits makes the FX the perfect rig for Amateur, CAP or MARS applications. Packeteers really appreciate the dedicated packet port. "TRUE-FM" signal and almost instant T/R switching. High speed packet? ...No problem. Twelve diode programmed channels, 5W RF output, sensitive dual conversion receiver and proven EASY assembly. Why pay more for a used foreign rig when you can have one AMERICAN MADE (by you) for less. Comes complete less case and speaker mike. Order our matching case and knob set for that pro look.

FX-50 kit (6 Meters) **$149.95**
FX-223 kit (1 1/4 Meters) **$149.95**
CFX matching case set.....**$29.95**
FX-146 kit (2 Meters).....**$149.95**
FX-440 kit (3/4 Meters).....**$169.96**
FXM-1, ICOM/Yaesu style speaker mike **$29.95**

QRP AMPLIFIER

For a slick little QRP boost, use one of the 20 Watt amplifiers. Needs only 1/2-2 watts of drive for full output, linear for SSB, AM or CW operation, power MOSFETs for high effiecency and multistage low pass filter for a clean signal. Built-in T/R relay for automatic switching, runs on 12-15 VDC at 2-4 amps. Add our matching case set for a complete station look.

Your choice of bands.....**$49.95**
Specify band: (QAMP-20, 30, 40, 80)
QCAMP Matching case set.....**$14.95**

2WAY RADIO SERVICE MONITOR

COM-3, the world's most popular low-cost service monitor. For shops big or small, the COM-3 delivers advanced capabilities for a fantastic price—and our new lease program allows you to own a COM-3 for less than $3.00 a day. Features • Direct entry keyboard with programmable memory • Audio & transmitter frequency counter • LED bar graph frequency/error deviation display • 0.1-10.000 µV output levels • High receive sensitivity, less than 5 µV • 100 kHz to 999.9995 MHz • Continuous frequency coverage • Transmit protection, up to 100 watts • CTS tone encoder • 1 KHz and external modulation.

COM-3 2 Way Radio Service Monitor **$2995.00**

2 MTR & 220 BOOSTER AMPS

Here's a great booster for any 2 meter or 220 MHz hand-held unit. These power boosters deliver over 30 watts of output, allowing you to hit the repeater's full quieting while the low noise preamp remarkably improves reception. Ramsey Electronics has sold thousands of 2 meter amp kits, but now we offer completely wired and tested 2 meter, as well as 220 MHz units. Both have all the features of the high-priced boosters at a fraction of the cost.

PA-10 2 MTR POWER BOOSTER (10 X power gain)
Fully wired & tested **$99.95**
PA-20 220 MHz POWER BOOSTER (8 X power gain) Fully wired & tested.....**$99.95**

SX-20 20 METER SSB/CW TRANSCEIVER

Finally, a handy go anywhere rig that puts the fun back into ham radio. How about the DDS synthesizer that tunes in 10 Hz steps with exceptionally low noise for weak signal reception. Or, how about the built-in lambic CW keyer that has a digital readout of your CW speed. Perky 10 watt RF output (that's only 11/2S units below a 100 watt rig!) can be tuned down for true QRP operation. Included with the SX-20 is the hand mike with handy UP/DOWN buttons for remote tuning of the rig while driving — or biking — or boating. Available in both fully assembled and fun to build kit form, you'll find that the SX-20 will become your favorite rig.

SX-20 20 meter SSB/CW Transceiver, fully wired, 1 yr. warranty **$429.95**
SX-20 20 meter SSB/CW Transceiver Kit Form.....**$349.95**
Optional CW Audio Filter SXCWN WT.....**$49.95** Kit **$39.95**

FOXHUNT HEADQUARTERS

Locate hidden or unknown transmitters fast. The Foxhound direction finder connects to the antenna and speaker jack on any radio receiver, AM or FM from 1 MHz to 1 GHz. The antenna (a pair of dipole telescopic whips) is rotated until the Null meter shows a minimum. A pair of LEDs indicate to turn Left or Right. The Foxhound is ideal to use with a walkie-talkie, if you wish to transmit, go ahead, a built-in T/R switch senses any transmitted RF and switches itself out of circuit while you talk. It doesn't get any easier than this! We provide all parts except for a few feet of 1/2 inch PVC pipe avialable at any hardwar e store for a dollar or two. Add our matching case set for a complete finished unit. Be the one with the answers, win those transmitter hunts and track down those jammers, you'll do it all with your Foxhound.

Add some fun to your club events by having a transmitter hunt! Foxhunting is a craze sweeping the nation, but many clubs are missing out on the action because they lack the expertise or time to develop their own foxhunt transmitter. We set one of our most devious and sneaky engineers to the task of designing an easy to build and use, yet highly capable Foxhunt transmitter. A snazzy microprocessor controller has both preset and programmable transmission characteristics allowing you to easily set the difficulty level from "beginner" to "know-it-all"! The SlyFox, FHT-1, is crystal controlled in the 2 meter band (crystal for 146.52 included) with a power output of 5 watts that is adjustable by the controller.The transmitter is programmed to ID in CW or add our voice option if you really want to aggravate the troops - "Ha ha, you can't find me!" Join the fun, get rid of those stuffy old meetings and picnics, have a foxhunt!

DF-1 Foxhound direction finder kit.....**$59.95** CDF Matching case set for DF-1 ....**$14.95**
FHT-1 SlyFox Foxhunt transmitter kit .**$129.95** FHID-1 Voice ID option.....**$29.95**
CFHT Heavy duty metal matching case set for FH T-1 .....**$29.95**

PACKET RADIO

Two new versions are available for the Commodore 64 (P-64A) or the IBM-PC (P-IBM). Easy assembly NO TUNING". Includes FREE disk software, PC Board and Full Documentation. Kit form.

P-64A.....**$59.95** P-IBM .....**$59.95** CASE CPK.....**$14.95**

Miniature SPEAKER-MIKE

Fits Icom, Yaesu, Alinco, Ramsey and Radio Shack rigs! Looking for a handy little speaker-mike to compliment your FX transceiver or other ICOM style handie-talkie? The Ramsey SM-1 speaker-mike is a beauty. It's only 1 1/2" wide by 2 1/2 inches high and has a handy clip on the back so you can easily clip it to your lapel or shirt. Its small internal speaker isn't going to break any eardrums but is very clear and has plenty of pop to be heard when worn. There's even a jack on the mike so when you plug it in, you still have the use of the speaker jack from your radio. Fits all Radio Shack, ICOM, Yaesu, Alinco and Ramsey rigs.

SM-7 Mini-Speaker mike, Fully assembled.....**$24.95**

CW KEYER

Send perfect CW. Microprocessor keyer features 4 programmable memories of up to 26 words each, lambic keying, dot-dash memory, variable speed from 3-60 WPM, adjustable sidetone, keying to any rig and fully RFI proof. EAROM memory keeps messages up to 100 years - you'll go silent before the key! Includes built-in touch paddles or use your own. Easy assembly and matching case set available for a nice station look.

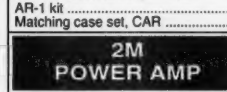
CW-700 Micro keyer kit.....**$69.95** MK Matching case set..... **$14.95**
CW-700WT Assembled CW-700and case **$119.95**

ACTIVE ANTENNA

Cramped for space? Get longwire performance with this desktop antenna. Properly designed unit has dual HF and VHF circuitry and built-in whip antenna, as well as external jack. RF gain control and 9V operation makes unit ideal for SWLs, traveling hams or scanner buffs who need hotter reception. The matching case and knob set gives the unit a hundred dollar look!

AA-7Kit.....**$28.95** Matching case & knobset, CAA..**$14.95**

AIRCRAFT RECEIVER



Hear exciting aircraft communications—pick up planes up to 100 miles away! Receives 110-136 MHz AM air band, smooth varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.

AR-1 kit **$29.95**
Matching case set, CAR **$14.95**

STEREO FM TRANSMITTER

Run your own Stereo FM radio station! Transmits a stable signal in the 88-108 MHz FM broadcast band up to 1 mile. Detailed manual provides helpful info on FCC regs, antenna ideas and range to expect. Latest design features adjustable line level inputs, pre-emphasis and crystal controlled subcarrier. Connects to any CD or tape player, mike mixer or radio. Includes free tuning tool too! For a pro look add our matching case set with on-board whip antenna

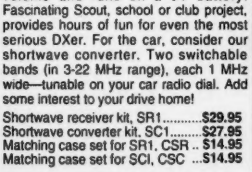
FM-10A Stereo transmitter kit .. **$34.95**
CFM Case,whip ant set..... **$14.95**

SPEECH SCRAMBLER

Descramble most scramble systems heard on your scanner radio or set up your own scambled communication system over the phone or radio. Latest 3rd generation IC is used for fantastic audio quality - equivalent to over 30 op-amps and mixers! Crystal controlled for crystal clear sound with a built-in 2 watt audio amp for direct radio hook-up. For scramble systems, each user has a unit for full duplex operation. Communicate in privacy with the SS-70. Add our case set for a fine professional finish.

SS-70 Scrambler /descramblerkit .**$39.95**
CaSD matching case set.....**$14.95**
SS-70WT Assembled
SS-70 and case set **$79.95**

SHORTWAVE RECEIVER



Fantastic receiver that captures the world with just a 12" antenna! Can receive any 2 MHz portion from 4-11 MHz. True superhet, has smooth varactor tuning. AGC, RF gain control, plenty of speaker volume and runs on a 9V battery. Fascinating Scout, school or club project, provides hours of fun for even the most serious DXer. For the car, consider our shortwave converter. Two switchable bands (in 3-22 MHz range), each 1 MHz wide—tunable on your car radio dial. Add some interest to your drive home!

Shortwave receiver kit, SR1.....**$29.95**
Shortwave converter kit, SC1.....**$27.95**
Matching case set for SR1, CSR .. **$14.95**
Matching case set for SCI, CSC ...**$14.95**

2M POWER AMP

Easy to build power amp has 8 times power gain, 1W in, 8W out, 2W in, 16W out, 5W is for 40W out. Same amp as featured in many ham magazine articles. Complete with all parts, less case and T-R relay.

PA-1, 40W pwr amp kit.....**$34.95**
TR-1, RF sensed T-R relay kit.....**$14.95**

MINI KITS

Ramsey carries a complete line of low cost, easy to build, easy to use functional kits that can be used alone or as building blocks in larger more complex designs. Mini-kits include audio amps, tone decoders, VOX switches, timers, audio alarms, noise-makers and even shocking kits! Call for our free catalogue!

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World's smallest FM wireless mike. Smaller than a sugar cube - including battery and mike. Two sets of SMT parts supplied in case you are clumsy! Terrific audio pick-up (pin drop at 5 ft) and transmit range of 300 ft. We include the battery (watch style), electret mike and even a tuning tool! Be a James Bond and learn SMT too!

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QRX . . .

Noteworthy hams

A list of "famous" hams was posted on the Internet. Do you know any famous hams not on this list? Let us know.

7L2NJY Dr. Mamoru Mohri, Japanese astronaut
9K2CS Prince Yousuf Al-Sabah
9N1MM Father Marshall Moran, missionary (SK)
A41AA Qaboos Bin Said Al-Said, Sultan of Oman
EAØJC Juan Carlos, King of Spain
FO5GJ Marlon Brando AKA Martin Brandeaux, actor
G2DQU Lord Rix (formerly Sir Brian), former actor and charity head
G3TZH Tony Dolby, brother of "the" Dolby
G3YLA Jim Bacon OBE, weatherman
GB1MIR Helen Sharman, astronaut
HS1A Bhumiphol Adulayadej, King of Thailand
IØFCG Francesco Cossiga, former President of Italy
JA5FHB Japanese Minister for Transport and Communications
JY1 King Hussein of Jordan
JY2 Queen Noor of Jordan
KØHWY Tex Beneke, band leader
K1OKI Mickey Schulhof, head of Sony US
K2HEP John Sculley, CEO of Apple (lapsed)
K2ORS Jean Shepard, author
K4LIB Arthur Godfrey, TV performer (SK)
K6DUE Roy Neal, television reporter
K7TA Clifford Stoll, author & scientist
K7UGA Senator (US) Barry Goldwater
KB2GSD Walter Cronkite, news reader
KB6LQR Jeana Yeager, Voyager '86 pilot
KB6LQS Dick Rutan, Voyager '86 pilot
KB6OLJ Paul J Cohen, mathematician
KC4OCA Gordon Barnes, weatherman
KD6OY Garry Shandling, comedian
KG7JF Jeff Duntemann, author
LU1SM Carlos Saul Menem, President of Argentina
N4KET David French, CNN newsman
N4RH Ralph Haller, FCC PRB chief
N5YYV Kathy Sullivan, Chief Scientist NOAA (former astronaut)
N6FUP Stu Cook, baseball player
NK7U Joe Rudi, baseball player
ON1AFD Count Dirk Frimouth, Belgian astronaut
S21A Head of Bangladeshi PTT
SU1VN/P Prince Talal of Saudi Arabia
SV2ASP/A Monk Apollo
U2MIR/UV3AM Musa Manarov, cosmonaut
VK2BL Graham Connelly, radio announcer
VK2DIK Dick Smith, entrepreneur & millionaire
VK2KB Sir Allan Fairhall, politician
VK2YOW Bob Hughes, radio announcer
VU2RG Rajiv Gandhi, Prime Minister of India (SK)
VU2SON Sonia Gandhi, XYL of VU2RG
WØORE Tony England, astronaut
W3ACE Armin Meyer, US Ambassador to Japan
W4ZG Worth Gruelle, started Raggedy Ann and Andy
W5LFL Owen Garriot, astronaut
W6EZV General Curtis LeMay (SK)
W6FZZ Samuel F.B. Morse III
W6JKV James Treybig, CEO of Tandem
W6QHS President of California Microware
W6QYI Cardinal Roger Mahony
W8JK John Kraus, astronomer
WA4CZD Chet Atkins, guitar player
WA4SIR Ron Parise, astronaut
WA6TJM President of ISD Inc.
WA7WYV Andy Griffith, actor
WB4KCG Ronnie Milsap, singer
WB6ACU Joe Walsh, singer
WB6RER Andy Devine, actor (SK)
WD4SKT Donny Osmond, entertainer
KD4WUJ Patty Loveless, singer
WP4CO Jose Feliciano, singer

New Zealand forcing CW to be dropped internationally?

At the last ITU WRC meeting (1995) an initiative was opened by the NZ delegation to visit this issue. The agenda item was not pursued at that meeting, but will appear as part of a larger "look" at amateur radio at the 1999 WRC.

Many national societies are now examining this issue, including ARRL, RSGB, RAC, IARU, etc. IARU and ARRL have established working groups to prepare for WRC-99. You should contact your national society with your views and recommendations as early as possible.

Agenda item "2.2 Consideration of Article S25 concerning the amateur and amateur satellite services" for WRC-99.(Art. S25 renumbers previous Art. S32 which contained Radio Reg. 2375, amateur Morse tests for HF privileges internationally.) As result, the IARU has established a committee called The Future of the Amateur Service Committee (FASC) to assist/ advise the IARU in formulating policy/positions on the above WRC-99 agenda item.

The committee has a long list of matters on the agenda, and the committee is to encourage full discussion of these matters; invite comments from individuals, groups, member societies, and regional organizations; participate in meetings and take into account comments it receives; prepare reports, recommendations, and proposals by the Administrative Council, member societies and others.

As a first step, all IARU member societies have been invited to send opinions to the chairman of the FASC (VK3KI) as to "how the Radio Regulations might be modified or improved to meet the challenges of the 21st Century".

The first regional conference to consider recommendations from the committee will be the Region 1 Conference to be held in Israel, September 1996. Others will be held over the following two years leading to WRC-99.

In the UK, the Radiocommunications Agency has asked the Radio Society of Great Britain to consider formally the proposal to delete Morse testing as a requirement for HF privilege. "Whether the Morse test is a relevant means of differentiation (between classes of license)...It is clear that this is an issue on which there are differing and strongly held opinions. It is now timely to reconsider this issue and to decide whether the Morse requirement is one in which radio amateurs see relevance to the next millenium."

In France, F6IIE, vice-president of UFT (Union Francaise des Telegraphiste) has written, "Let those who are against the CW exam not delude themselves, they risk having something other than CW to learn. Those who are in trusteeship will not do away with (overnight) a 'filter' so efficient for controlling access to the HF bands...the CW examination is not really so difficult...it opens up horizons certainly more interesting than all the data-processing systems (which are) useful indeed, but of which one tires so quickly, and which render communications more and more impersonal." (Translated from *La Pioche*, journal of UTF, by Ken Quigg GI4CRQ, and printed in *Morsum Magnificat*, Feb. '96.)

This will be a hot topic in the two and a half years before WRC-99. Be prepared to respond to surveys/ polls by ARRL and probably others, and to clearly express your reasons for retaining or dropping Morse as a requirement for HF operating privileges. Obviously the English and French are moving out smartly to face the issue, and do have opinions already in mind!

We are only a few months away from the first meeting at which the issue will be formally discussed in light of the WRC-99 agenda, so you might want to organize some thoughts carefully on the issue and maybe E-mail or post to the FASC committee member of your country, or nearest you.de AH6NB

Hams get help from Baker

Rep. Bill Baker (R-California) has introduced a bill to protect ham volunteers in the Volunteer Examination program and the Amateur Auxiliary of the FCC from frivolous lawsuits while they are doing their volunteer jobs. The bill, HR 3207, would afford amateurs engaged in statutorily defined activities with the VE program and with the Amateur Auxiliary the same liability as federal workers under the Federal Tort Claims Act. When individuals who fall under such protection are sued for something they have done while performing their duties, the Federal government steps in to protect them. Baker introduced the measure, the Amateur Radio Volunteer Services Act of 1996, March 29, 1996, as an amendment to the Communications Act. While the bill would not afford absolute blanket immunity, it does offer a fairly rigorous body of legal protection from the kind of malicious litigation that tends to frighten volunteers away from these activities, said ARRL Legislative and Public Affairs Manager Steve Mansfield, N1MZA.

Baker said that Amateur Radio volunteers provide an invaluable service to all ham radio operators by assisting in licensing and monitoring activities, thus saving taxpayer dollars. Those savings would dry up if volunteers stay away for fear of lawsuits, Baker said in a letter to colleagues. The bill is a simplified version of legislation originally introduced in the 103rd Congress by Rep. Jim Slattery. Individuals and private organizations currently protected by the Federal Tort Claims Act include Volunteers in Service to America (VISTA), the Peace Corps and the Job Corps.

Baker has enlisted members of both parties as original cosponsors of the bill. These include: Charles Wilson (D-TX); Bob Wise (D-WV); Edolphus Townes (D-NY); Mike Parker (R-MS); Toby Roth (R-WI); Charles Taylor (R-NC); Ron Dellums (D-CA); David Funderburk, K4TPJ, (R-NC); Ed Royce (R-CA); Norman Dicks (D-WA); Vern Ehlers (R-MI); Chris Cox (R-CA); Andrew Jacobs (D-IN); Harold Rogers (R-KY); Dennis Hastert (R-IL); Dave Weldon (R-FL); Anna Eshoo (D-CA); Ken Calvert (R-CA); Doug Bereuter (R-NE); Gene Green (D-TX); George E. Brown (D-CA); Eva Clayton (D-NC); and Sam Farr (D-CA).

Hams may want to write their own Congressional

Representatives urging them to support HR 3207. (From: *ARRL Bulletin* 19, 4/96.)

Harrisburg, PA, hams help in floods

About thirty volunteers from a Pennsylvania radio club came to the aid of the Red Cross to help after the Susquehanna River overflowed its banks, flooding the state capital on January 20th. According to John Obradovich W3IS, President of the Harrisburg Radio Amateur Club, hams provided communication between Dauphin County Red Cross headquarters and two mass-care facilities that lacked telephone service. The following day, the Red Cross requested additional volunteers with vehicles for disaster assessment training and reporting. Several hams were among those who reported.

No electronic renewal

The FCC will not renew your license electronically. So says the ARRL's Regulatory Information Branch in response to several recent queries. The League says that you can now download Form 610 from the FCC fax-on-demand service or from the FCC's home page on the World Wide Web.

The FCC now only renews a ham radio license if an application is received within 90 days before or two years after the expiration date. It will not be renewed if submitted earlier. And, if you apply for renewal after your license has expired, you may not operate until the application has been processed.

As announced last year, there is really no good reason for a person not to renew his or her license prior to expiration. Since last fall, the FCC has been sending out a mail-in reminder called Form 610-R. You should receive it at least 90 days before your ticket expires. If all of the information is correct, you just need to sign the form and return it. If for some reason you do not get a Form 610-R, a regular Form 610 is OK to use. From AMATEUR RADIO NEWSLINE

NEVER SAY DIE

Continued from page 6

know all the players. Suddenly I found that the ARRL General Manager, the League counsel, and the directors all thought of the members as sheep, with no opinions worthy of consideration. It's the same arrogant attitude I see in most politicians.

Hey, if I suddenly "die" of a heart attack, I want you to know that my heart is in fine shape and that the CIA seems to leave a trail of heart attack victims who have caused trouble. Shades of the KGB! The Apollo mission data is still highly classified, so my reporting on the book may be endangering our country.

Exit Line

When this book arrived and I saw that it was an exposé of NASA, claiming that the moon flights were all faked, I expected to start reading the usual unsupported baloney like that which supports just about every claim I've read for zero-point energy, N-machines, and other mysterious new power sources. I was a 100% total believer in space flight. Oh, I didn't think the potential benefits of visiting Mars were worth the investment, considering the federal deficit, so I was glad to see that program canceled last year. Ditto the super collider.

But I've been a space fan since childhood. I got hooked early by a cartoon strip around 1929 called "Jack Swift." No relation to Tom Swift, though later in my childhood I enjoyed those books. Buck Rogers was there, but he didn't hold a candle to Jack Swift. Nor did Flash Gordon. Heck, the early Buck Rogers cartoons still had people using airplanes in the 25th century. Tsk.

So the whole idea that the Apollo flights had been no more real than the recent

Continued on page 13

The Discharger

A NiCd nurse you really should build.

Marion D. Kitchens K4GOK
2709 Colt Run Road
Oakton VA 22124-1101

A battery *discharger*? Why would you want to discharge batteries? There are two reasons for discharging your NiCds. One is to measure the capacity of the battery pack to determine if it has exceeded its useful life. We all know that even NiCds have a finite life span, but we tend to assume they are good forever in everyday practice. Many NiCds are, however, rated for about 1,000 discharge-recharge cycles.

The other reason for discharging your NiCds is to recycle them to recover from "low energy memory." If NiCds are only partially discharged and then recharged repeatedly, they tend to "remember" this limited duty cycle and will not thereafter deliver their full rated capacity. They can often be recovered by a series of controlled discharges and recharges.

The Discharger was intended to help 4 to 12 NiCd cells, and allows measurement of the energy capacity of the pack. It can be used to determine when batteries are no longer useful, and as a test device to measure the useful life of a variety of different battery types. Knowing a battery pack's useful life or capacity can be a lifesaver in situations where battery discharge can result in damage or loss, such as in radio-controlled model airplanes. When used in recycling batteries, the Discharger will provide a measure of capacity for each discharge-recharge cycle to let the user determine whether or not progress is being made. The Discharger will automatically measure the time to discharge a battery pack so you can read it later at your convenience, thus eliminating the need to monitor the process in real time.

The Discharger is simple to build and to use. There are no critical adjustments or fussy circuits. All parts are readily available from a variety of sources. I have included a PCB layout, a Parts List, and parts placement drawings. Etched and drilled PCBs are available from FAR Circuits (18N 640 Field Court, Dundee IL 60118), or you can make your own. LED indicators show the state of circuit operation. You simply build it and use it, after checkout of course. Data measured on batteries at this QTH are provided for comparison with your batteries.

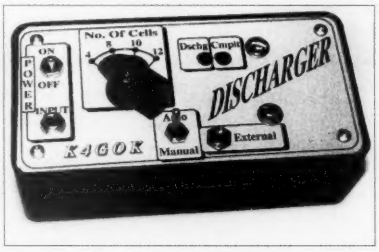

***Photo A.** The completed discharger (prototype unit).*

I you enjoy building and using simple "hassle savers," you will want to build the Discharger. It's a handy test device to have around your ham shack.

Theory

The purpose of the Discharger is to discharge your battery pack at a known current rate (200 mA in the design), and measure the time it takes to discharge the batteries. The time-current product is then a measure of your battery pack capacity in mA-hr. Discharge is to a voltage of 1.0 volts per cell in the pack. The Discharger circuit compares the battery pack voltage to a known voltage, and when the voltage is 1.0 volts per cell in the pack, the Discharger switches to an idle current (12-15 mA) and thereby terminates the discharge.

Fig. 1 shows a functional block diagram of the Discharger. The circuit is powered from the battery pack being discharged. A multi-position switch provides a voltage tap-off from the battery pack to the comparators, dependent on the number of cells in your battery pack. That voltage is compared to a stable 2.5

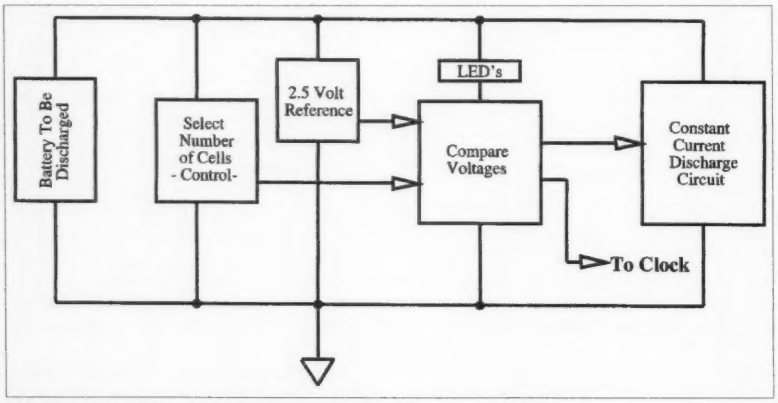

***Fig. 1.** Discharger block diagram.*

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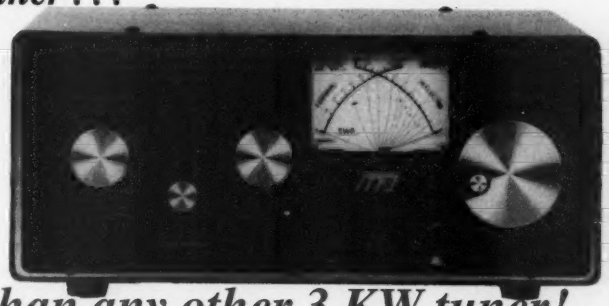

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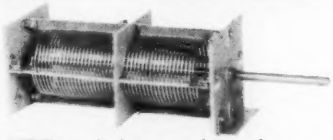

MFJ's exclusive *super heavy duty AirCore*™ Roller Inductor has an air core that can't burn up! You get ultra high-Q, the lowest loss, highest efficiency and highest power handling of any roller inductor in ham radio.

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Large, self-cleaning wiping contact gives excellent low-resistance connection without arcing or contact burning.

A *solid* ¼ inch brass shaft with self-align bearings gives smooth non-binding rotation.

Some competing "legal limit" tuners use a lossy, low Q, solid core with erratic electrical contacts and have potentially damaging self-resonant frequencies. This can cause excessive heating and can destroy the core.

Massive Transmitting Capacitors

Look inside . . . you'll see two *super heavy duty* transmitting variable capacitors that can handle 6000 volts. Extra wide (0.27 inch) stator plate spacing gives you arc-free operation.

Specially shaped plates give low minimum capacitance when unmeshed. This and a hefty 250 pf maximum give you an extremely wide matching range -- even on 160 and 10 Meters.

The nearest competing "legal limit" tuner has variable capacitors physically *much smaller* than the MFJ-989C's. Theirs is rated at 4500 volts -- a full *25% less* than the MFJ-989C. Theirs is more likely to arc -- *not what you want in a "legal limit" tuner!*

Super Antenna Switch

The MFJ-989C *super heavy duty* antenna switch is made of *two* individual *ceramic* wafers wired in parallel. Extra wide spaced, heavy duty contacts handle extreme voltages and currents. *We've never burned one up!*

You can select two coax antennas (directly or through tuner), balanced line/random wire, or built-in dummy load.

3 KW *Current* Balun

MFJ's *super heavy duty* 3 KW *current* balun for balanced lines uses *two* giant 2½ inch toroid cores. It's wound with *Teflon®* wire connected to high voltage *glazed ceramic* feedthrough insulators.

The MFJ-989C lets you safely operate high power into balanced feedlines without core saturation or voltage breakdown.

Some "legal limit" tuners have inferior *voltage* baluns with smaller diameter toroid cores and use soft plastic feedthrough insulators that can arc and melt.

More reasons why the MFJ-989C is the world's finest 3 KW tuner . . .

Built-in Dummy Load

A full-size 300 watt non-inductive 50 ohm dummy load is built into the MFJ-989C.

You'll find it handy for transmitter tuning, testing and repairing your rig, setting power level, adjusting your mic gain and more.

Some "legal limit" tuners *don't* have a built-in dummy load. They want *you* to pay for an external dummy load that just gets in your way.

Lighted *Cross-Needle* Meter

MFJ's lighted *Cross-Needle* SWR/Wattmeter lets you monitor SWR, forward and reflected power *simultaneously*. Read both peak and average power in two power ranges.

Sleek and Compact

The compact MFJ-989C slides right into your operating position -- you'll hardly know it's there. It's just 10¾x4⅓x15 inches. *Do you really want a bulky "legal limit" tuner that's bigger than your amplifier?*

Superior Cabinet

The MFJ-989C's *premium*, low-profile all-aluminum cabinet has a sub-chassis that adds strength and RFI protection.

Every cabinet is chemically treated and has a tough, scratch-proof vinyl cladding -- not paint that can scratch or chip off. You won't find a tougher, longer-lasting finish anywhere.

Detailed logging scales and legends are *permanently* silk screened on *real* aluminum front and back panels -- they aren't decals or glued-on paper strips that can peel off.

Superior Construction

Every MFJ-989C uses PEM nuts (*not* self-tapping screws), wing-nut for ground post (*not* a cheap nut), fire-retardant epoxy glass PC board (*not* canvas based), heavy guage wire throughout (*not* small guage), locking compound on nuts/bolts (*not* loose hardware).

No Matter What™ Warranty

Every MFJ-989C is protected by MFJ's famous one year *No Matter What*™ unconditional warranty. We will repair or replace your MFJ-989C (at our option) *no matter what* for a full year.

Others may give you a *limited* warranty on defects in material and workmanship.

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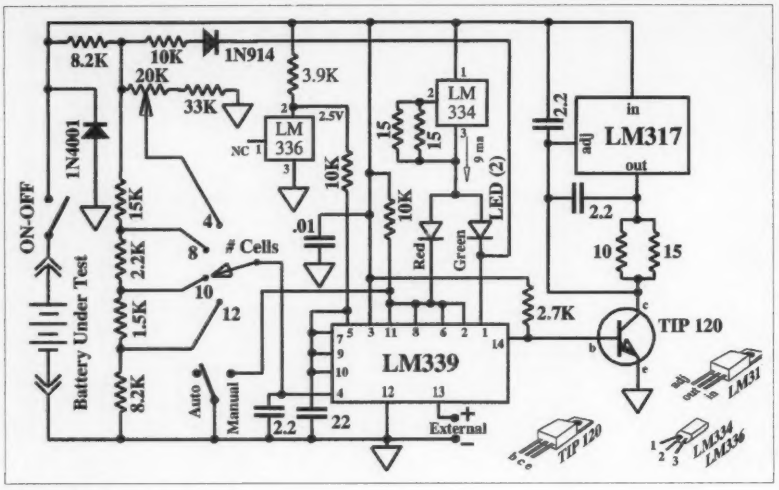

Fig. 2. Discharger schematic.

volt reference. As long as the voltage on each of the cells in your battery pack remains above 1.0 volts, the constant current discharge circuit is activated, as are the appropriate LED indicators.

Discharging to less than 1.0 volts is not recommended. For example, on a four-cell pack, the voltage would be 4.0 volts when the discharge is completed. When the battery pack voltage falls below 1.0 volts per cell, the discharge circuit is disabled and the circuit goes into an idle mode. To measure the discharge time, an external clock is also active as long as the discharge circuit is.

The discharge current of the Discharger is set at 200 mA, so a 400 mA-hr. battery pack should discharge in about two hours if it is at rated capacity. The external clock should then measure a discharge time of around two hours.

The complete schematic is shown in **Fig. 2.** A resistor divider string allows selection of the number of cells in your battery pack, thus providing a suitable voltage to the LM339 comparator. An LM336 2.5 volt reference provides the other input to the LM339 comparator. The remaining comparators of the LM339 are used as logic elements to operate the LEDs, the External control (clock), and the LM317 constant current part of the circuit. Note that the LM339 enables/disables the LM317 circuit by controlling the series TIP-120 transistor. The LM334 provides a constant current of about 9 mA for the LEDs, to prevent burnout with the wide range of voltages over which they have to operate.

Note that the 10k resistor in series with the 1N914 diode connected to pin 1 of the LM339 provides hysteresis to prevent the discharge circuit from re–energizing once the discharge cycle is completed. The Auto/Manual switch forces the LM339 logic into the discharge mode when in the Manual position, which is useful in certain situations, but not normally used. The 1N4001 diode across the battery input prevents reverse polarity from being applied to the circuit. An in-line fuse should be used so it will blow if the battery connections are accidentally reversed.

The only comparator actually being used as a simple comparator is the one with inputs on pins 4 and 5, and output at pin 2. The other comparators in the LM339 chip are being used as logic gates to control the rest of the circuit. The red LED is on as long as the battery pack is being discharged. It switches off and the green LED comes on when the discharge is complete.

Construction

The construction is rather straightforward using the PCB. The PCB foil pattern is shown in **Fig. 3**. Check out each portion of the circuit as it is constructed. The unit is designed to fit a 5-1/16" long, 2-5/8" wide, 1-5/8" deep experimenter box with a metal closure. Note that the usual thin sheet metal closure that comes with the experimenter box does not provide an adequate heat sink and should be replaced with a panel at least 1/16" thick. **Fig. 4** shows the drill pattern for the enclosure.

Study the schematic (**Fig. 2**) and the parts placement drawing (**Fig. 5**) before starting construction.

First, put in all the resistors, caps and diodes. Install the LM336 and LM334, and tack solder the LEDs in place. Check to make sure these are all installed with proper polarity; it's easy to install the LEDs wrong. The anodes of the LEDs should be connected to the two 15Ω resistors. Do not install the LM317, TIP-120 or LM339 yet. Use an in-line fuse of about 1 amp, and apply 5 VDC to the board. The fuse will blow if you connect the power with reverse polarity—that's what it's for. On 5 VDC, the current should be only about 1 mA. Check for proper voltages on the IC socket. Only pin 12 should be connected to ground. Pins 5, 7, 9, and 10 should be at 2.5 volts, and pins 2, 3, 6, 8, 11, and 14 should be at 5.0 volts.

Next, jump pin 2 to ground, and the red LED should light up. Jump pin 1 to ground and the green LED should come

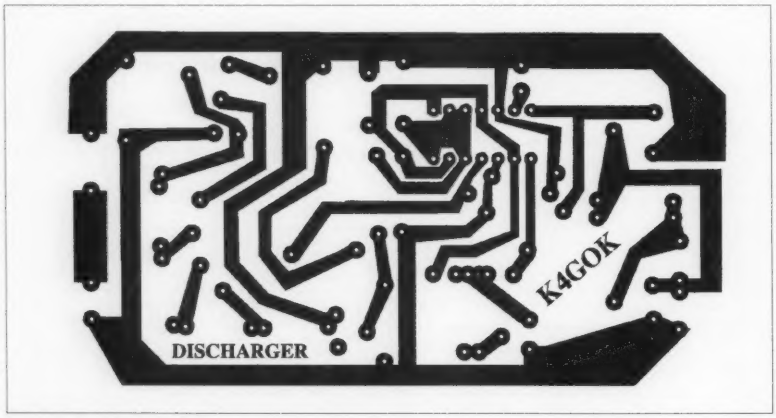

Fig. 3. PCB layout pattern.

NEVER SAY DIE

Continued from page 9

award-winning Apollo-13 movie was totally preposterous. But once I started reading I couldn't stop. Indisputable evidence piled up, fact after fact. As far as I know, no one who has read the book remains unconvinced that the world has been sucked in by one of the biggest snow jobs in history. If you read the book and aren't amazed at the enormousness of the deceit, and the success NASA and the CIA have had in keeping it secret, I sure want to hear from you.

Well, they did as good a job with secrecy on the Manhattan Project back 50-some years ago, so it's not without precedent.

And why didn't Russia blow the whistle, when they had to know early on that man would never survive in space beyond the Van Allen Belt without massive shielding against the intense radiation from solar flares? Read the book on our cost to bribe them.

Say, I wonder what else our beloved government has been doing that we haven't heard about? Let me know, okay?

Radio Bookshop

I've been going out of my way to avoid selling the books I've been recommending, knowing that some money-oriented readers would cry that I was "just trying to sell books." On the other hand, some of the books I've recommended are difficult to find, so I'll start adding some of them to the Radio Bookshop inventory. The Bookshop, which I started in 1958, has always been just a service, and never organized for a profit.

Anyway, if you're interested in having something really interesting to talk about on the air, I've arranged for Radio Bookshop to handle the NASA book. I don't think you're going to find it in any book stores. Send $25 plus $5 shipping/handling to Radio Bookshop, 70 North 202, Peterborough NH 03458. If you order any other books (like mine, for instance), the one shipping charge covers everything. Foreign orders will have to be more to cover the shipping. (See order form page 88.)

Instinct?

Now what in heck is instinct? European cuckoos, which are raised by birds of other species, migrate without guidance to precisely the spot in Africa where their parents migrated before them. Fish return to the streams where they hatched to spawn. Turtles find the exact same beaches where they were born. Monarch butterflies make one migration, from the Great Lakes region to specific butterfly trees in Mexico. The examples that "science" explains as instinct are endless. So, what's instinct?

What science can't explain it gives a name to and ignores or denies.

How do lost animals find their owners in places they've never been before? When a rat learns to navigate a maze, how can future unrelated generations be born with the knack for similar mazes? Is there a whole lot more to the adaptation of species than random Darwinian survival of the fittest?

If you decide to do some research along these lines you'll find organized science fighting you every inch of the way with ridicule, a refusal to publish your papers, and efforts to prevent any funding. Is it any wonder that our progress in non-accepted scientific fields has been so slow?

In the US I've seen the efforts of the Department of Energy scientists to make absolutely sure that if a new cold fusion industry develops, it will be in Japan, not here in America.

According to *The Skeptical Inquirer,* telepathy doesn't exist, yet almost every day I experience it with Sherry. She'll be driving along, with me in the back seat working, and I'll suddenly look up and remark on a sign or something unusual. Every time, it's something she's particularly noted and wanted to tell me about, but didn't want to interrupt my work.

I've reviewed books for you on how to communicate with plants and animals. Science is doing well with microcircuit development, but sure has a long way to go (with other scientists fighting every inch of the way) toward understanding psi, instinct, and other such phenomenon it doesn't understand and thus ignores or denies.

The comforting thought is that virtually every scientific belief (law) is eventually shown to be either untrue, or just partly true.

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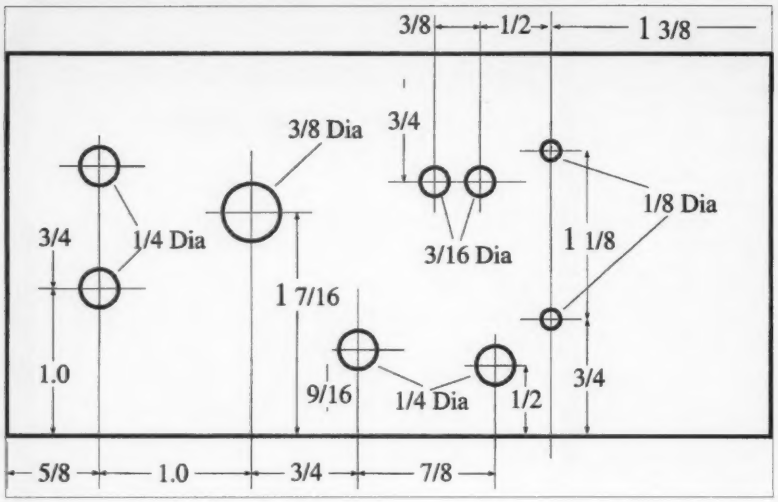

Fig. 4. Drill hole pattern for a 5" x 2.5" panel.

on. Connect the "Manual" (Auto/Manual switch) copper land to ground and the red LED should light up again. Remove the 5 VDC power before installing the LM339 in its socket, and check for proper orientation. Simulate the #4 Cell switch position by temporarily connecting pin 4 of the LM339 to the wiper of the 20k pot. Apply 5 VDC to the unit and the green light should flash briefly before the red light comes on. Current consumption should be 10 to 12 mA with the red LED on. Adjust the 20k pot for 3.08 volts on pin 4 of the LM339. You may want to refine this adjustment later. The control switches, LM317 and TIP-120, should be mounted next.

See **Fig. 6**, **Fig. 7**, and **Photo C** for the suggested method of doing this.

Note the orientation of the rotary switch, making sure the solder lugs are aligned with the PCB solder holes. Only four "positions" and the "pole" of the rotary switch are used. The switches and jacks should be mounted on the sheet metal closure, and short solid wires soldered to the pins as shown. The LM317 and TIP-120 should be mounted to the angle aluminum with insulators, as shown in the drawings. Be sure to use thermal compound when mounting the LM317 to the aluminum angle.

Next, bolt the aluminum angle to the closure, using thermal compound between the aluminum angle and the 1/16" thick closure. The assembled PCB should then be positioned over the solid wires and the LM317 and TIP-120 leads. Note that the circuit components are oriented toward the switches and closure. Make sure the ground lugs of the two jacks are connected to circuit ground, and the other lugs are connected to the positive battery input and to the output of the LM339 chip (pin 13). An error here will cause a short circuit!

Push the assembled PCB down until it is about 1 inch above the front metal panel (closure). Make sure it is square with the metal panel before soldering the connections. It is a bit of a chore to get all the wires in place, but be patient—the result is worth the effort. Now solder all the wire leads to the circuit board. You might want to adjust the length of the LED leads at this point for proper protrusion through the closure. **Photo D** shows the resulting components all mounted on the circuit board. The closure serves as the Discharger front panel (see **Photo E**). If you are not following the suggested construction technique, be sure to mount the LM317 on a suitable heat sink, and insulate it from ground. The TIP-120 needs to be insulated too, but since no heat-sinking is required it can be left free-standing on the PCB. **Photo F** shows WØDLQ's standard construction technique.

Continue the checkout as shown in the **Discharge Checkout Sequence** sidebar, using a variable voltage power supply to simulate the discharging battery pack. The supply should be rated at more than 200 mA, and capable of controlling the voltage to the indicated values accurately and easily. Conduct these tests in the sequence shown; otherwise the results can be confusing. When conducting the tests listed in this sidebar, you will note that the supply voltages for the switch between the red and green LEDs is different when the voltage is decreasing than when the voltage is increasing. That is because of the built-in hysteresis. It is the decreasing trip points that need to be accurate. That's what's happening as a battery is being discharged, of course, and that is what this circuit is for—discharging batteries.

As a final check, you could verify that the External connection goes to ground when the red LED is on. An LED with a current-limiting resistor makes a good indicator for that. Make sure the positive input goes to pin 13 of the LM339 chip, and ground goes to the Discharger ground. Limit the current into pin 13 to about 12-15 mA. The LM317 should not get hot on a 4 or 5 volt supply. You might want to check its temperature on higher battery voltages to verify that your heat sink is adequate.

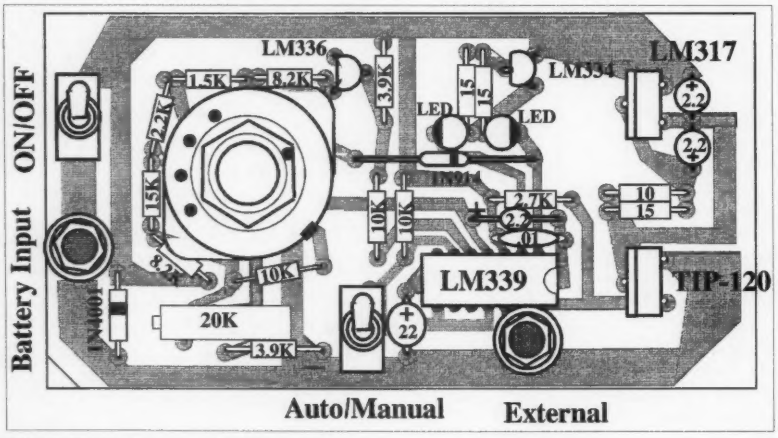

Fig. 5. Parts placement diagram.

NEVER SAY DIE

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Epileptic Fits

Thank heavens for the fast-forward on my VCR remote! Well, with exposé TV programs on almost every night, there's always the chance that if I don't record them I'll miss finding out about another military-industrial complex boondoggle, another Congressional, medical, food stamp, welfare, and so on scam. The fast-forward button helps me avoid not only the commercials, but the wallowing in others' misfortunes, which the networks squeeze for every teardrop on these shows.

Did you catch the "Dateline" program with the exposé on the medical scandal over epilepsy? Any time you think that old Uncle Wayne is exaggerating about the mendacity of our so-called health care servers, who fight every low cost cure for a serious illness ferociously, all you have to do is a little reading. Like the *Racketeering In Medicine* book, which I recommended moons ago. Yes, it's on my list of books you're crazy if you don't read.

The program explained that around 70 years ago a very successful cure was found for epilepsy. But since it did not call for the use of any pharmaceuticals, the medical industry buried it. Except for one woman, who fought the medical bureaucracy for years, this cure would have been lost. Now kids with epilepsy can get this dietary treatment at Johns Hopkins, but only if they learn about it. Unfortunately, the AMA-FDA-NIH-WHO cartel has done a magnificent job of keeping most doctors unaware of this simple cure.

Maybe you saw the program about the Australian doctor who discovered an inexpensive quick cure for ulcers. The medical establishment fought him tooth and bloody nail for years before he finally won. I think it was the article about him in *The New Yorker* which finally blew off the lid. The medical journals, which play only the pharmaceutical company tunes, refused to publish his papers.

Let's Play Doctor

There's a new book (well, new to me) that'll be on the next expansion of my list of

recommended books. This is *Let's Play Doctor,* by Dr. Joel Wallach. He's the Nobel Laureate nominee who started out as a vet for around 17 years and then, as he puts it, got his license to kill, his MD.

I got introduced to Wallach by three different readers, who sent me tapes of a talk he gave called "Dead Doctors Don't Lie." I should put the tape on my book list; it's spectacularly interesting. So I sent for his book. Wow! I find I'm using it almost every day for reference. It's a large format book, 203p, 1995, $13 from Wellness Lifestyle, Box 1222, Bonita CA 91908.

Wallach points out that most of the illnesses from which people suffer also used to afflict animals and thus be costly to farmers. Simple, inexpensive cures for these illnesses were discovered years ago by veterinarians. Today, animals no longer suffer from arthritis, Alzheimer's, diabetes, heart trouble, and so on. Just the victims of our "health care" industry. Sorry, but the more I learn, the less I trust doctors, lawyers, politicians, and the chairmen of other major industries. Oh yes, and any government bureau…except, of course, the FCC.

The question arises…are you and all of your family in top-notch, fit and trim, robust health? If not, are you interested enough to learn more about your problems and maybe solve them? Probably not, if it means having to read some books. Right?

Healthy, Wealthy & Wise

How does that resonate with you? Well, in addition to my occasional grumbles about how we can make amateur radio more fun, I've been thinking and

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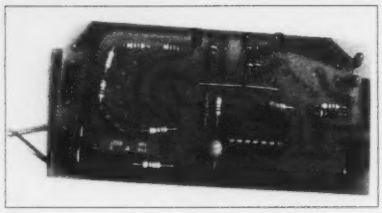

Photo B. *Completed PCB assembly, without switches, etc.*

Use a battery-operated mechanical clock so that it retains the display after power is turned off. The Discharger turns the clock power on when the battery pack is being discharged, and off when it is finished. Set the clock to 12:00 at the start of a run so that it will display the exact discharge time when the run ends. The connection at the External is an open collector NPN transistor inside the LM339. It can be used to operate a variety of things other than the clock, if desired. The transistor is rated at 15 mA and 35 V. **Photo G** shows the Discharger, battery, and clock ready for operation.

Operation

Connect your clock with its battery wire through the External jack as indicated in **Fig. 8.** Set the Auto/Manual switch to the Auto position, and the No. of Cells switch to the number of cells in your battery pack. For example, if your battery pack contains four cells, set the switch to position 4. Be sure to use a 1 amp fuse in the line between your battery and the Discharger, and plug your battery into the Input jack. Turn on the power switch, and check that the clock is running. Reversed polarity connections between the clock and the Discharger will cause the LEDs to blink on and off—make sure the polarity is correct and the clock is running. When the discharge is complete the red LED will go off, the green LED will come on, and the clock will stop. Record the time on the clock after discharge is completed. Multiply that by 200 mA and you will have the mA-hr capacity of the battery pack just tested. For example, if the clock reads one hour and 45 minutes, your battery pack has 350 mA-hr capacity.

To get a more precise measurement, you can measure the discharge current by putting a mA meter in the power leads when initiating the discharge—you should have recorded this value during checkout. This value will change very little as the battery is being discharged, and is reasonably independent of the battery pack voltage; therefore, it can be measured only once, and then that value can be used for all battery pack discharges.

To determine if your battery pack has exceeded its useful life, you will want to put it through several charge/discharge cycles. Start with a fully charged battery pack, and measure its discharge time. Make sure that the mA-hr measured is near the rated capacity of your battery pack. If it is, simply recharge the pack and put it to use. If the measured mA-hr capacity is not near the rated capacity, you will want to "recover" the battery pack. To do that, repeat the discharge/recharge cycle several times. After three charge/discharge cycles, the battery pack should show increased mA-hr capacity if it is still useful. Repeat the charge discharge process until the battery pack no longer increases its mA-hr capacity. Doing this a few times will make the user appreciate the Auto feature of the Discharger, because you don't have to monitor the process—just read the clock when it is convenient.

Proper operation of the Discharger assumes that all cells in the battery pack are good. A shorted cell will cause improper voltages and improper operation of the unit. You will normally want to start with a fully charged battery pack. Note that the Discharger will not operate properly on battery pack voltages below about 3.5 volts.

During normal operation the Auto/Manual switch should be in the Auto position. That allows the internal circuit to determine when the voltage on each cell in the battery pack has reached 1.0 volts, and shut down the 200 mA discharge current. If your battery pack has a number of cells not selectable from the No. of Cells switch, then you can use the Manual operating mode. In this mode, the discharge circuits are forced into 200 mA discharge current operation, independently of the battery pack voltage. Therefore, the operator will have to monitor the battery voltage manually to determine when the battery pack is discharged. Discharge of battery packs with more than 12 cells is not recommended because of the thermal load they impose on the LM317. The red and green LED indicators tell the operator what discharge mode the circuit is operating in. When the red LED is on, the battery pack is being discharged at 200 mA. When the green LED is on, the discharge is completed and the current has been reduced to about 10 mA.

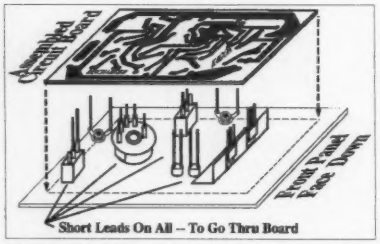

Fig. 6. *Suggested assembly sequence*

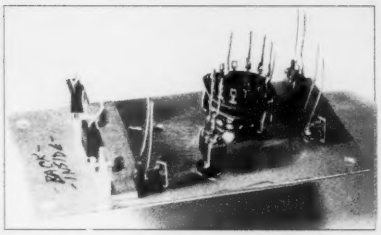

Photo C. *Leads on switches, ready for PCB attachment.*

Measured results

The results of measuring the capacity of a number of NiCd battery packs are shown in the **Battery Discharge Data** sidebar. Note the sometimes small, but notable, improvements achieved by the discharge/recharge cycling. Some battery packs (not shown in the charts) were found with quite weak cells and showed marked improvements via the cycling process. For comparison, the chart shows the mA-hr capacity measured for a fresh set of Alkaline AA cells.

Acknowledgment

The contributions of Gene WØDLQ played an important part in the design and refinement of the Discharger circuit.

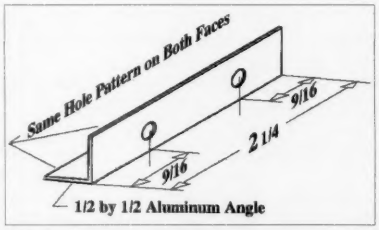

Fig. 7. *L-mounting bracket.*

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Please fill out this multi-purpose card when you want to place a Subscription to 73, renew your Subscription 73, order FREE Reader Service information, and/or tell us what you think of this issue by filling out the Feedback part of the card.

Our entire staff thanks you...your card will be entered in our monthly drawing when you include Feedback information about this issue.

NEVER SAY DIE

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writing a good deal about the HW&W aspects of life...much to the annoyance of monomaniacal hams. But the listener response to my appearance on the Art Bell (W6OBB) radio talk show was almost enough to get me thinking.

It was a three-hour interview and Art sells the tapes, if you're interested. It originally was broadcast on November 17th, and then rebroadcast on January 1. I talked a lot about amateur radio (of course) and a bunch of other things.

While my enthusiasm for amateur radio brought a few inquiries for more information, my discussion of health was the one that resonated the most and resulted in something over 2,000 letters. If you got a response like that to an interview it might almost make you think too.

Let me sum up my message. If you're interested in being healthy, wealthy, and wise, you have to start first with wisdom. And that means reading. If you read the right books you'll be healthy and wealthy. I'm convinced that you can, by making some nutritional changes, double your normal life span. And by knowing the well-kept secret to wealth, you can become a millionaire in five to seven years, starting from scratch.

The catch is simple. It's *change*, and most people would rather die (and will) than change their habits.

Health

Let me put this simply. After reading a lot and talking with some people I trust as experts, I'm convinced that when it comes to long-term illnesses, they're *all* the result of poor eating habits. And most, if not all, can be reversed by changing your diet. If you eat right and add the minerals and vitamins that are long gone from our industrially truck-farmed land, you're not going to have diabetes, arthritis, Alzheimer's, Parkinson's, heart attacks, brittle bones as you age, and so on. Worse, you can raise holy hell with the Social Security system by living to 120-150 years in good robust health.

I won't go into the details of what foods and additives you need in your diet, but I have a pretty good idea, and it includes changing your drinking water to eliminate chlorine and fluorides, as well as very small, but pervasive amounts of new chemicals. Maybe you read the article in the January 15th ('96) *The New Yorker* on the plummeting sperm count worldwide. I've been recommending this magazine for a long time for anyone interested in developing wisdom. Hey, you aren't born wise, you have to work diligently to build wisdom. The Good Lord wipes the RAM slate clean with each new incarnation.

Anyway, the article says, "But in this century we have generated all these new chemicals and injected them into the environment, and suddenly the body is exposed to new substances that in some cases can interact with hormone receptors. The human species is totally unprepared for this, because it has never happened before." For instance there's "Dioxin, which is a byproduct of chemical manufacturing and of the paper-and-pulp industry, which is present at low levels nearly everywhere in the environment, and can cause an astonishing amount of damage." The article goes on to explain that rats given a very small dose of Dioxin during pregnancy produced males with a 60% reduced sperm count. A widely used pesticide, vinclozolin, emasculated the male pups.

Organic farmers avoid the pesticides which are in our supermarket food, but their produce still doesn't have the minerals we need.

Look, our bodies adapted to the foods and waters in the environment over millions of years. Now, just in the last few decades, we've stopped getting the minerals and vitamins our bodies were designed to use. The result is a wide range of illnesses and a cutting of our life span in half. This also has affected our immune systems, making us much less resistant to passing bugs and infections.

There is also the impact of pain, both physical and mental, which lowers our immune system. But there are some ways to reduce this substantially, thus keeping the immune system strong. I'll have to write an instruction book on how anyone can do that. It's not difficult, but it's not presently accepted by the medical-industrial complex. Your doctor may be as kindly as mine, but he does not have your best interests at heart. The medical industry only makes money when you get sick, so they have a $1.4 trillion stake in your getting sick. If all they had to do was repair people damaged in

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CIRCLE 41 ON READER SERVICE CARD

A much better-engineered design resulted from his contributions. All builders will thank Gene for building a unit in parallel with the original prototype, thereby providing necessary unit-to-unit variables and a more refined design.

My NiCds are now in better condition than ever before. The Discharger is easy to duplicate and can save considerable hassle with your NiCds. Building it is fun and the result is rewarding. Build one for yourself! 73

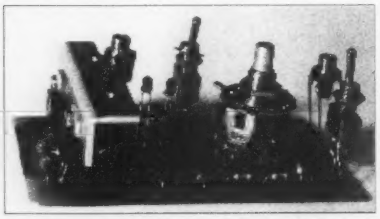

***Photo D.** Completed board with all the parts mounted.*

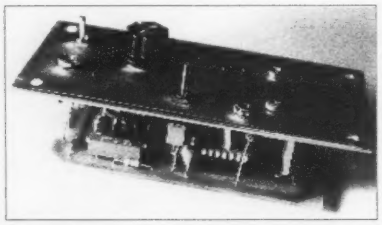

***Photo E.** The board mounted on the front panel, ready for paint and labeling.*

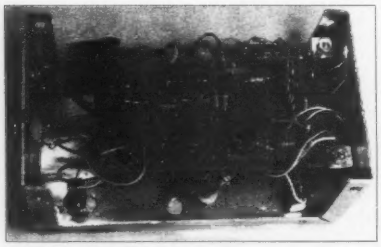

***Photo F.** WØDLQ's Discharger–standard construction technique.*

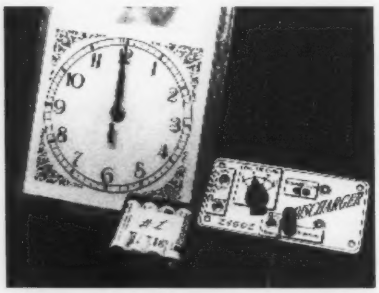

***Photo G.** The Discharger, with the clock, ready for operation.*

Checkout Sequence

Conduct the following tests with a variable voltage supply in lieu of the battery pack.

1. Connect a 5 volt power supply to the battery connection points of the Discharger, observing proper polarity.
2. Set the Auto/Manual switch to the Auto position, and the # Cell switch to the #4 position.
3. When you turn on the power switch, you should see a very brief flash of the green LED, followed immediately by the red LED coming on and staying on.
4. If for some reason the red LED does not come on, put the switch momentarily in the Manual position, and then back to the Auto position.
5. Adjust the 20k pot for 3.08 volts on pin 4 of the LM339, with the red LED on.
6. Switch to #8 position, and the green LED should come on, and the voltage on pin 4 should drop noticeably.
7. Set the switch to #12 and the supply voltage to 15 volts, in that order.
8. If the red LED does not come on, switch momentarily to the Manual position, and then back to the Auto position.
9. Slowly decrease the supply voltage through 12 volts. The green LED should come on when the supply voltage is close to 12. Note that going up from below 12 volts will require higher voltage to get the red LED to come on. This is normal.
10. Switch to position #10, making sure the red LED comes on.
11. Slowly decrease the supply voltage through 10 volts. The green LED should come on when the voltage is close to 10.
12. Switch to #8 position, making sure the red LED comes on.
13. Slowly decrease the supply voltage through 8. The green LED should come on at 8 volts.
14. Recheck the #4 supply voltage operation to see if it has changed. If necessary, readjust the 20k pot so that the green LED switches on just as the voltage is decreased to 4 volts.
15. Measure and record the current drawn by the Discharger while the red LED is on. It should be near 200 mA.

Battery Discharge Data

Battery	Pack	Size	Discharge #	mA-Hrs.
#1	AA	#1		171.1
		#2		391.1
		#3		389.2
		#4		398.2
#2	AA	#1		291.2
		#2		444.3
		#3		433.5
#3	C	#1		1053.4
		#2		1099.8
#4	AA	#1		347.3
		#2		462.1
Alkaline	AA	#1		1554.2

Parts List

Resistors (All 1/4 Watt)
10 ohm
15 ohm (3)
1.5k
2.2k
2.7k
3.9k
8.2k (2)
15k
10k (3)
33k
20k trimpot

Capacitors
22 µF
2.2 µF (3)
0.01 µF

LEDs (small)
1 red
1 green

Semiconductors
TIP 120
LM 317
LM 334
LM 336
LM 339
1N4001
1N914

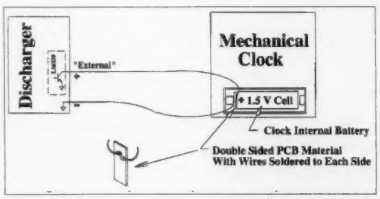

***Fig. 8.** Clock timer connections.*

NEVER SAY DIE
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accidents, the industry would be more like a $500 million complex, with almost no pharmaceutical companies, and a tenth as many hospitals. Calling it a "health care" industry is as honest as calling the War Department the Department of Defense. Har-de-har. Let's really be nice and call it the Peace Department and have a Secretary of Peace.

Wealth

As with health, accruing wealth calls for a change in the life patterns which have been rather thoroughly ingrained. If you want to make more money than the lower middle class you are going to have to spend time doing the necessary homework. School? College? Forget it. Once you've learned to read, school is an enormous waste of time. Self-education is the key, and that means reading and asking questions.

If you have the guts to break your well-ingrained habits and start eating right, and learning, you can make all the money you want and have a darned good change to live to 150 in good health. Have you the willpower to not smoke that cigarette? To not swizzle another beer? To turn off the TV and read one of the books on my "You're Crazy if You Don't Read" list?

Have you ever bothered to read Napoleon Hill's *Think and Grow Rich* Pocket book? He first published it in 1937 and it's still in print. How about Parkinson's Laws? In Parkinson's *The Law and the Demand,* his Third Law points out that almost anyone can become a millionaire by the time they're 25 if they drop out of school at 15 and self-educate themselves from then on. That's the same thing I've been preaching.

The basic question is this: Are you a lemming or a pioneer? Getting a ham ticket shows a small sign of independence, so there may be an as yet unsmothered spark of guts somewhere within you. Our schools system and society in general put a heavy pressure on you to shut up and be a lemming. Don't make waves. If you ever work for a large corporation, any branch of the government, the military, or teach, you quickly find out how dangerous to your career wave-making and ideas can be. But in those directions lie enforced mediocrity and semi-poverty.

Our public school system was copied by our churches in the early 1800s from the Prussian model, which was designed to provide men for the Prussian army who would obey orders without question. The last thing the army or the church wanted to develop was a thinking population. Thinking equals trouble. The churches wanted unquestioning churchgoers and business needed people educated just enough to work in the factories of the industrial revolution.

The adventure of packet, ham satellite communications, the microwaves, foxhunting, and so on all provide an incentive to learn more about radio and electronics. Is it fear that's keeping you from exploring these new territories? Or stick-in-the-mudism? I'm always disappointed when giving talks at hamfests and I ask for a show of hands of those who are on packet. Those on RTTY? SSTV? Satellites? How many have worked more than 300 countries? How about going on a DXpedition?

No, they're on the local repeater. They call into a 75m net. 2m SSB? Nope. Meteor scatter DXing on 2m? Nope. Maybe some aurora contacts on 2? Okay, what do they know about M-PEG and compression algorithms? Why am I not seeing any hands?

Wisdom

How many people do you know who are really healthy? How many are wealthy? How many do you consider wise?

The response to my interview on the Art Bell talk radio show was encouraging and started me thinking about some sort of a newsletter or magazine devoted to helping people to make their lives better. But what could I do about procrastination? Most of us, even when we know what we're doing is destructive to our health or wealth, can't stop ourselves. Well, I'll eat this now and diet tomorrow. I'll watch the ball game today and exercise tomorrow. I'll put that new antenna up next week. Sure, I'd probably make more money if I'd read some books...and I will when I find time. Yes, I've been there and done that, so I know all about it personally.

As we get older and find our lives more and more restricted by the things we've done to our bodies, we finally start getting more interested in health. We start wanting to learn, at long last, about what food, water, air, exercise, sun, EMFs, poisons, and all that stuff we've pretty much ignored has done to us. And then, what the heck we can do about it now, if it isn't too late?

Some of us get angry when we find that the tobacco companies have knowingly been poisoning us. That the power companies have been doing ditto with their power lines. That the pharmaceutical companies, with the assistance of the FDA, NIH, WHO, AMA, and so on have been not only poisoning us, but doing their best to keep us from finding out how to be healthy. That scientists in general don't know what the heck they are talking about. And that our whole society is rigged to make sure that you don't ever make much money.

Do you think there is enough interest in breaking out of the all-pervasive, destructive pattern we've been living to support a newsletter? Probably not.

Skeptic

Now and then a book comes along that gets me all excited. "Wow!" stuff. Like the René book exposing the whole moon landing program as no more real than the "Apollo-13" movie. Which apparently was a documentary-type movie of a completely fictional event. The *NASA Mooned America* book will be on the next update of my list of

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Wheelchair Mobile

Dave Skinner KC5NLK operates from his wheelchair.

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Little Rock AR 72227

The CW class is about to begin when David KC5NLK and his dad, John KA5VAQ, arrive. David Skinner wheels into place, begins to set up his PC laptop, and prepares to copy code. After eight weeks of class he's confident he can nail down the 5 wpm exam. One week later he does, at the volunteer exam session.

Despite David's confinement to a wheelchair due to muscular dystrophy, he leads an active ham life. Dave can be found on the local repeaters, talking to some of his buddies. In addition, he works on a computer, using a specially designed mouse for input.

Photo A. *Dave Skinner KC5NLK in his wheelchair mobile.*

Because Dave did not want radio frequency (RF) hitting the back of his head and needed an antenna with some gain for use with his radio, His dad designed and built an antenna that uses an automobile up/down motor to raise and lower the whip. It enables Dave to use the higher gain antenna with higher power while keeping the RF well above his head. He can lower it to get through doorways and to miss those ceiling fans commonly used here in the South.

"Equipped with his laptop computer and VHF transceiver, David can be in either voice or digital communications from wherever he sits."

While on the subject of heat, only someone familiar with Arkansas summers knows the fierceness of the late June heat on the afternoon of Field Day. David was out there working the VHF station, chasing those contacts on an early evening E-skip. He also managed to enjoy the fellowship and traditional potluck dinner served by the Metropolitan Amateur Radio Club at its annual Field Day effort. David listened intently to the senior members of the Ozark Would Be Adventurers and Liars Club, who always meet on Saturday evening of Field Day. We now consider him a junior member along, with several of the other younger hams present.

He doesn't let his disability stand in his way. Dave has served as net control for the weekly Metropolitan Amateur Radio Club 2 meter net and participates in public service activities. He was recently elected Club Secretary for 1996. Aided by technology, Dave is able to contribute and participate with his fellow hams. He is currently working on upgrading to General Class.

He does seem like a young man in a hurry. If you don't believe it, just stand by while he zooms down the hall in his electric wheelchair mobile, living up to the tradition of teenage drivers. The batteries provide power for his chair motor, as well as for his on-board high-technology ham station.

Equipped with his laptop computer and VHF transceiver, David can be in either voice or digital communications from wherever he sits.

"He has been a real inspiration to other hams and a contributor to the club," said Kenneth Keplinger N5XLX, president of the Metropolitan Amateur Radio Club.

If you are passing through Little Rock, Arkansas, give a shout on the 146.07/67 WB5GFA repeater for KC5NLK. There's no telling where you'll find him in his mobile communications "shack." 73

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"books you're crazy if you don't read."

As soon as I read that book I called René and asked what else he had. A few days later *The Last Skeptic of Science* arrived. It's another page-turner I couldn't put down. It's self-published, 179p, 1995, $25. As soon as I read it I faxed René to send me some copies to make available through Radio Bookshop.

Why did I get so excited? Well, René (nom de plume) fearlessly tackles Newton, Einstein, Hawking, Hubble, et al and wins. Do you really, honestly believe that the moon causes our tides? Or that there really have been ice ages? Or that there is a gravity force? Or that there ever was a Big Bang? Or black holes? An expanding universe? Or hundreds of fundamental particles? Or that the earth's magnetic field has reversed itself? Or that we have the field because the earth is a big magnet? Or that volcanos are caused by leaks from the earth's molten interior? Or that the transmutation of elements is either impossible or difficult? That the speed of light is constant? That objects of different weights drop at the same acceleration in a vacuum? Or that the ice cap over Antarctica is millions of years old?

René does a masterful job of tackling things scientists (he calls them science philosophers) and most of the rest of us have been taught to accept as facts and laws, reducing them to exploded theories. If you are a heavy believer in the authority of the scientific establishment this is a book you'd better not read, just as his moon book is best not read by people who are true believers in the honesty of our government.

For instance, when I got a call from Len WA2IHI about his efforts to help get the word around on the Beck blood purifier, I mentioned the NASA book to him and he got a big laugh out of it. April Fool, right? So I suggested he stop reacting for a moment and think. Remember the photos and movies of our astronauts walking on the moon and the footprints we could plainly see? Sure. Well, have you ever walked in hot, dry sand? You don't leave any footprints, just dents. It takes moisture to hold sand or dirt in place to leave a footprint and the moon's surface is about 250°F during the two-week day, so it is as dry as anything is ever going to get. It certainly is not going to register footprints. Unless moon dirt, unlike any other dirt, dust, or sand ever discovered, has some magical properties which bind it together, allowing individual grains to stick to each other.

Len squirmed and then said that obviously moon dirt is different. It holds footprints and tire tracks. Sure, and to hell with facts. I hung up, chuckling.

René cites dozens of solid reasons why nobody has yet been able to visit the moon. After reading this book you'll have something to talk about on the air besides all that money you put into your big antenna.

Both the NASA exposé and the Skeptic book are $25 (plus $3 s/h) from Radio Bookshop. I'll be surprised if you don't add both of these to your list of the most exciting books you've ever read.

René's ideas tie in with what I've learned recently from other books on my recommended list, such as *The Big Bang Never Happened*, by Eric Lerner, *Footprints of the Gods*, by Graham Hancock, and so on.

Maybe you've watched some of the recent TV exposés of the way the pharmaceutical companies, in conjunction with the AMA, FDA. NIH, WHO, and so on have covered up inexpensive and effective cures for ulcers and epilepsy. If so, you can understand why I'm reading every book I can find on alternatives to the current sickness repair system, and perhaps why I have less and less faith in authority figures. And that particularly holds for Ph.D.s and our beloved government. I suppose I should have been warned, since Ph.D. stands for a doctor of philosophy, not science.

Little that I was taught about science in high school and college has stood the test of time. I was taught that our solar system got started when another sun passed close to ours and sucked off the stuff making the planets. And my college physics classes never once mentioned quantum mechanics.

Say, I hope you are enjoying being with me on my adventure into learning about our universe, health, and so on. I've always found it exciting to learn new things, and I have this drive to share the things I enjoy with as many others as I can. Amateur radio has provided me with endless adventure as I've learned about one new mode after another. I've had a ball DXing, DXpeditioning, and contesting. I'm frustrated at failing to get our Techs to upgrade and experience the thrill of working a VK or ZL on 75m phone, or the fun of making contacts through our ham satellites.

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Upgrading Your Transmatch

Make your buddies sick with envy by adding a Ten-Tec tuning bridge.

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Much to Wayne's chagrin, any regular listener on the ham bands will find out in short order that the hot topic of conversation most evenings is equipment, and of all the equipment that hams love to talk about, antennas are number one. If you listen long enough you will also find out that there are really only two basic types of hams: those who buy the biggest, tallest, and most expensive antenna systems their spouses and their communities will allow and then talk about them incessantly; and those who don't, and talk about *that* incessantly. I fall into the latter group. There are a variety of reasons for this, not the least of which is that I'm a ham because I love to build things, and antennas are among the few pieces of gear that won't cost an arm and a leg to fool with. Besides, they can be as simple or as complex as your mother-in-law. In other words, any idiot can build one—even I can.

When I first began to experiment with odd bits of wire on slippery rooftops, I was fortunate enough to own one of those remarkable little radios from Japan that included, among other extraordinary features, a little bitty antenna tuner that would whir and growl and click its way to a perfect match between its transmission line and my rooftop creations. Alas, as the last sunspot peak began to wane I was forced back onto resonant antennas, first by the addition of a linear amplifier and second by trading up to a transceiver with a bit more basic receiver performance. I now drive a new American rig that doesn't have one of those fancy tuners. Oh well.

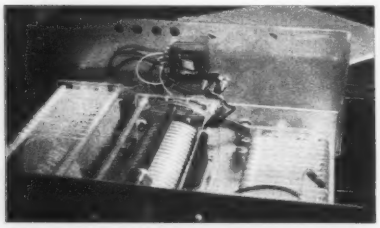

***Photo A.** Install the relay, RCA power jack, and a fuse on the back panel of the transmatch.*

Clearly what was required here was an external transmatch of some sort so that I could deliver all those gobs of power to my loops and longwires and windoms. The big shock came when I began to price automatic antenna tuners for kilowatt stations. I hoped there was a less painful way...and there was.

Tuning a transmatch

I had known for some time that an ordinary noise bridge, of the type used to measure the impedance of an antenna circuit, could be used as an aid to tuning a transmatch. You will recall that these devices, available commercially and described numerous times in amateur publications, inject a noise signal into a bridge circuit comprised of an unknown antenna impedance and a variable capacitance in series with a variable resistance. While listening to the noise at the transceiver, you adjust the variable capacitor and resistor until a sharp null is obtained, then read the calibrated values of these components and modify the antenna to suit. If you substitute a 50 Ω resistor for the variable R/C devices and insert a transmatch in series with the unknown antenna impedance in this circuit you will have created a great aid to tuning a transmatch. Now you simply adjust the variable portion of the unknown arm of the bridge until the null is obtained. The transceiver will then be looking into a 50 Ω load.

All of this without emitting a lot of rude and offensive signal onto already crowded bands! This was important to me. With one or two possible exceptions, there is nothing quite so annoying as a tuner-upper doing his thing right in the middle of an ongoing QSO or net operation. Even more irksome, perhaps, is the knowledge that the guilty party has probably followed the old admonition to move a little off frequency to tune up; he's not going to be bothering his buddies a bit, but doesn't mind dumping a little QRM on the other guy as long as it's anonymous.

The Ten-Tec bridge

So along comes TKits, a division of Ten-Tec, with a new product line that serves up a simple circuit on a board, complete with parts for stuffing and an excellent instruction manual, at rock-bottom prices. I thought that their kit #1051, a "Transmatch Tuning Bridge," and my old Murch 1.5 kW "Ultimate Transmatch" ought to team up for the perfect "almost automatic" antenna tuner. They do, and it works terrific!

There's a phrase I first encountered in the works of Lewis Carroll that ring true for any project of this sort: "Begin at the beginning, then continue on until the end, then stop!" Having said that, however, there are a few words of caution and encouragement and some advice of a general sort that I'd like to impart by way of preparation for the journey. First, just about any antenna tuner would be suitable for this project, as long as there's some extra room to mount the circuit board and its interface to the tuner "under the hood." Secondly, if you're made like most of us you are probably a little uneasy about poking

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Selenium

As I read the latest stack of club newsletters I kept seeing obits for local hams who have died of heart failure or stroke. Veterinarians solved that problem for animals decades ago. Farm animals don't die of heart attacks or strokes. Farmers add pellets with the minerals which are missing from today's crops to their animals' feed. But don't ask your doctor about preventative medicine, vitamins or minerals—they're not his field. If doctors were taught anything about health maintenance instead of just about repairs they wouldn't be dying an average of 17 years younger than the rest of us.

They're taught how to treat symptoms.

Cows, pigs and horses don't die of heart attacks or Alzheimer's because farmers give them the minerals they need with their feed. Well, that's something for you to think about as the ambulance rushes you to the emergency room. That old ounce of prevention. Or more likely, 50 mg of selenium or some other missing mineral that's critically important to your body's function.

No, I'm no MD, nor even a DVM, so I don't ask you to believe me. But I recommend that you do your homework the way I have. I realize that you may not have much time to read, what with your time on the air, a little time at work, watching ball games and sitcoms — all making you a living example of the boiled frog syndrome: If you drop a frog into boiling water, he'll jump right out. But if you put him in warm water with a fire under it he'll enjoy the warmth until he's boiled.

And that's the way it is with our smoking, using drugs, and eating food that lacks the basic minerals and vitamins our bodies developed dependencies on, over millennia of design. Our bodies were designed to work on raw wild foods. They were never designed to cope with coffee and doughnuts or Big Macs and fries. So, either we have to figure some way to get our bodies the materials they need, or settle for half a life. The expression "You are what you eat," is right.

The Silent Keys column doesn't explain what SK'd the recipient of this final ARRL Award, but club newsletters usually go into more detail. I'm still disappointed at reading about hams who have done much for the hobby only in club newsletter obits. What a shame!

For instance, in the "Badger State Smoke Signals" there was a very nice obit about Travis Baird W9VQD. Travis stroked out (a mineral lack). He was into music, opera, speed skating, photography, sailing, football, computers, the violin, ATV, and so on. Now he's gone.

Twenty of the 73 books on my list of "books you're crazy if you don't read" are health oriented. The most important is *Maximize Immunity* by Dr. Bruno Comby. I got a fax from him this morning saying he's planning on moving to the US to establish a healthy-living community. If you read *The Secrets of the Soil*, another of my recommended books, you'll find out how to grow food that has the missing minerals.

Ever since the invention of the flush toilet we've been getting rid of the minerals in our crops instead of refertilizing our fields with them, as people did up until this century. Now we use chemicals as fertilizer, and we're suffering the consequences.

Hmm, I wonder how many of you grew up in the country with a backhouse and had to shovel out the privy every spring? My family's farm in Bethlehem, NH, had no running water and no electricity, so I know what it is to take a flashlight out to the privy in back of the barn at night in the rain. And there was no heat until the first one up (me) started the fire in the kitchen stove with newspaper, kindling, and some kerosene to get the wood going fast. And another fire in the living room fireplace, when it was really cold. While the stove was warming up I'd refill the kerosene lamps. The stove had a water tank at one end, so once the water was warm enough I'd scoop some out into a five-gallon watering can. Then, in the summer kitchen, out by the woodpile, I'd hoist the can over my head with a pulley and take a fast shower. That part of the house was unheated by the stove, so five gallons of water was plenty.

America At War!

Short quiz: What is the most expensive war in American

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***Photo B.** Install the switch on the front panel.*

holes in the front panel of a piece of factory-built gear. Don't be. There aren't many genuine collectors' items out there, and if you had one you would already know it. Besides, we are going to do an absolutely superb job of this and will actually increase the value of the piece. Finally, and this is very important, there is an even older saying that goes something like "One cannot make chicken soup out of chicken manure." We will need to be willing to acquire a few new tools if our finished project is to have the quality that we desire. See the sidebar.

The first thing I noticed as I unpacked the kit was that Ten-Tec had gone to great pains to provide decent documentation. Over the years I have assembled a number of projects that were hailed as marvelous in advertising copy, but proved to be largely design-and-build efforts when they hit the bench. Not so the TKit! The instruction manual reminded me a bit of the old Heathkit manuals: offset printed, well organized, and intended to be a permanent addition to the shack library. If I have any bone at all to pick with its authors, it's that they either failed to recognize or forgot to mention that the tuning bridge will not work if your receiver's noise blanker is engaged; its manufacturer actually intended it to be that way. Mash the old N.B. off button, however, and you'll have an abundance of noise that you can tune by. In any case, read the manual thoroughly and use the check-off format as you work through stuffing the board. Trust me–follow this advice and you'll have far less trouble to shoot later, and you'll have a more enjoyable experience to boot.

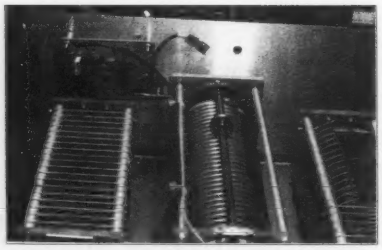

***Photo C.** The circuit board mounts on the back of the front panel.*

Assembly

Before stuffing the board, you should lift the hood on the old transmatch and find out what kind of room we have for parts placement. This an important step, by the way, not only for this project but for any that you may take on. I've had a number of discouraging setbacks over the years when my impetuous nature urged me to leap forward before I'd even determined in which direction forward lay! Planning is more important to a satisfying outcome here than even the most perfectly soldered joint. We can easily re-solder a cold joint but it's always tougher to rip it all out and start over when we've made a haphazard start. In any case, start by taking stock of the total number of components and their possible locations within the unit.

"There is no surer way of letting the smoke out of one of these little ICs than sticking it in the holes with the notch at the wrong end."

You will have to decide whether to use a relay or a heavy duty switch to transfer between the tuning and transmitting functions. The decision was easy in my case; I already had the relay. Bear in mind, though, that using manual switching will require that you route high power RF to some point in the case where the switch can be located so as to allow easy manipulation of its handle. It's not as easy as it sounds, but it's certainly possible given some care in the routing of RG-8. Don't use RG-58 or other mini types in this application; they may not handle the high voltages typically found inside transmatches. On the other hand, use of a relay should allow placement of the transfer function directly adjacent to the input jack from the transmitter. The wiring diagram in the instruction manual illustrates the appropriate hookup. Use the normally closed contacts for the transmit mode and don't worry about the relay coming apart here; we are not switching RF, only transmitting when the contacts are at rest. By the way, you may want to avoid using a relay socket here. It will only add unnecessary cost and bulk in the installation. You can firmly attach the relay to the case with silicone adhesive and then solder directly to the pins (see **Photo A**).

While in the neighborhood of the back of the case, give some thought to how you will power the circuit board and the relay (if used). Though a 9 volt battery can certainly be used, most of us have a source of 13.8 volts around the shack with enough extra juice to power a project like this easily. I use RCA type jacks and plugs for low voltage DC at my station, with good results. Inexpensive audio cables are handy for feeders to various gear; just make sure that everything is plugged in properly before powering up, and that each source jack is adequately fused. In any case, drill a hole in the back panel of your tuner to accommodate whatever power jack you decide to use. Be careful not to drill into any components within; use a wood block if necessary to shield stuff from accidental puncture. It's amazing how deeply a 1/16th pilot bit can penetrate before either pain or dismay can persuade the brain that a pull-back response is in order.

Now that you have power it's time to locate and install the power switch. The switch I used is a two-pole unit so that I can energize the transfer relay and the circuit board with a single handle. It can be located at any convenient point on the front panel. Notice that most of these small switches have a tiny indexing groove on the barrel that is supposed to key into a tab protruding from the circumference of the hole cut to accept it. (What?) Never mind. I don't know anyone who has one of those punches. Just drill a tight round hole and use the hardware that came with the switch to make the most secure fit that you can. The object here is to keep the thing from spinning in its hole so that you don't know which way is on. A dab of silicone adhesive on either side of the switch body will keep things snug. Use great

Tool Acquisition Program for the Beginner

If you are reading this, you no doubt have acquired over the course of your life a conglomeration of tools with which you amaze everyone. You can perform such stunts as: extracting an errant toothpaste cap from the depths of a bathroom sink drain, replacing an electric light bulb from the front of an automobile, or inadvertently flipping the odd hamburger patty from the backyard grill into range of the family Rottweiler. These tools will not do. We will not be tightening screws here with a butter knife. If one truly aspires to be a genuine, true blue, Double Throwdown Electronical Wizard, then one must acquire a simple kit of quality tools. Rather than try to describe every item that should comprise this kit, I will profile a few that I have found helpful, if not essential, for a project of this type.

The first tool on my "must" list is always a decent multimeter. There is only one brand to buy, as far as I'm concerned, and that's Fluke. It's probably not kosher to plug a brand like this, and there are probably other good units out there, but that's my opinion and I'll stick to it. They are spendy when new, but are available reasonably on the used market. Try the back pages of *73* or *Ham Trader Yellow Sheets*.

Make something to hold the PC board still while you stuff it or solder components in. I knew a guy who didn't have one of these and he is now a Silent Key! Honestly, you cannot stay sane and complete a project like this without something that performs this function. Get a piece of 1/4-inch steel rod about 10 inches long. Bend a 90° turn about 2 inches from one end of it and jam the other end into a hole drilled in a block of wood. Use a hose clamp to fasten an ordinary spring clip to the end sticking up and you're done. These clips are called "Pony Clamps" and they are available in the woodworking section of large hardware stores. Send me $12 and I'll round this stuff up for you. If you feel like you just can't handle it, send me $32 and I'll send you the completed work clamp. Take heed, though, I'm making an enormous profit here, on something you could easily do yourself.

Ever notice how a drill bit worms around all over the face of your work before it decides to dig in and perform its function? Or after having drilled the holes for a row of indicator lights, you discover that they look like a tiny slalom course laid out on your panel front? The only way I know of to achieve acceptable results when fabricating the sheet metal for a project is to carefully, thoughtfully lay out each penetration, and then double-check each part for fit and clearance inside the case. Then get a spring-loaded center punch. To use one, place the hardened tip exactly where you are going to drill your hole and then press down firmly until the escapement mechanism lets go inside. *Voilà!* A perfectly centered punch mark to guide the pilot bit.

Now about those holes. Any hole drilled through a chassis starts life as a 1/16th-inch diameter pilot hole and increases size by stages until the proper fit is achieved. Take a look at **Photo E.** The two tools on the bottom are known as step bits and they are invaluable for rapidly producing just the right hole to suit the situation. After use, wrap them in a few turns of electrical tape so that they won't lose their edge rolling amongst all the detritus at the bottom of your tool box. The third device from the bottom is the aforementioned spring-loaded center punch. The tool on the top is a deburring tool, or a countersink. All right, as a countersink it leaves a little to be desired, but it does a whale of a job knocking down those razor-sharp little fuzzies that adhere to the edges of a freshly drilled hole.

***Photo D.** The workbench, with a meter, soldering iron, center punch, an equipment clamp, and bits.*

Buy a decent soldering iron, or make a cheap temperature control unit for a cheap soldering iron by using an ordinary incandescent light dimmer. I bought my fancy Weller iron at an electronics surplus joint for $5. Get a coaxial cable stripper! Mine is made by Corex, has replaceable blades, and cost under $20. Get a set of those tiny little jewelers' files. If you do drill a hole slightly off-center, sometimes you can get things back in line with a little judicious filing. Wear safety glasses, please. I've taken metal particles in the eye twice in my life, and glass beads on one occasion. The glass bead incident occurred in spite of the use of glasses. Believe me, what they do to you down at the emergency room sucks all the way through to the end, not to mention the possible consequences to your vision if you're not as lucky as I was. Be safe and have fun.

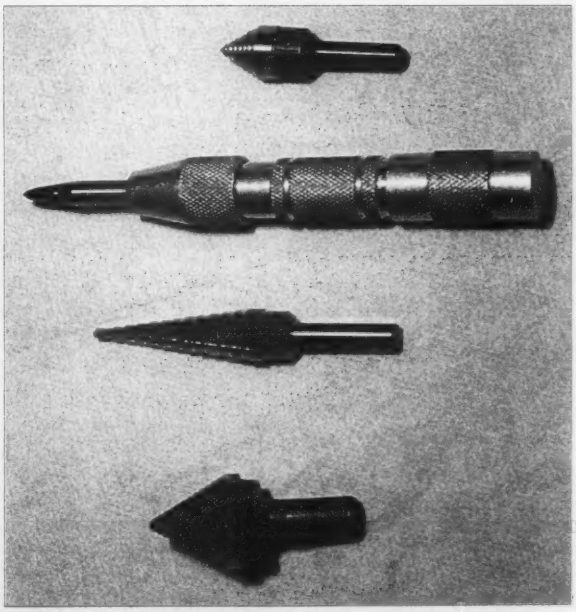

***Photo E.** Center punch and three very handy drill bits.*

care tightening the front nut to avoid leaving nasty gouges in the panel face with your pliers (see **Photos B and C**).

Next, you have to decide where the circuit board goes. A nice trick is to use existing hardware, if that's possible. You may be able to fabricate a couple of small angle clips to allow attachment of the board to an existing component mount. Be aware that you must maintain clearance between live parts and grounded surfaces here. I used common standoffs, available at Radio Shack™, but have frequently used short pieces of plastic tubing, cut to length, with long screws to match. If you're fortunate, you will have enough room on the floor of the chassis or rear panel to mount the thing, and still route all the conductors that terminate there smoothly. Use some common sense, though. It is neither desirable nor necessary to make elaborate 90° turns everywhere, just to lead a few wires across the inside of a piece of gear. You will want to follow some sort of plan that keeps things together, takes advantage of a general structural element perhaps, or uses those little stickyback pad eyes to tie things down with wire wraps. Should you choose to install the board against the backside of the front panel like I did, there is a bonus possibility that you can mount the circuit's LED indicator directly to the circuit board (see **Photo C**). If you do, just make sure that you lay out the mounting holes and the LED hole using the board as a template before you stuff it. Then select standoffs of a length sufficient to allow just the tip of the LED to protrude through the hole in the panel. Also, remember to solder the LED onto the side of the board opposite the rest of the components, leaving its leads as long as possible. This will allow access to the adjustment pots after the unit is mounted in place.

Go ahead and stuff the board now. If you've read the sidebar you know how important it is that you have some way to hold the circuit board while you are working on it. Follow directions, placing the parts precisely as they are laid out for you in the manual. Pay particular attention to placing the right stuff in the right holes in the right direction. You know, it never ceases to amaze me how frequently I get ICs plugged in the wrong way. There is probably no surer way of letting the smoke out of one of these little devils than sticking it in the holes with the notch at the wrong end. If you do, don't worry. The little 556 dual-timer that this circuit uses is available at Radio Shack for about a buck. Better pick up two...and a socket in case your luck stays bad. I substituted a 47 Ω resistor for R-12. (Actually, it turned out to be a 49 Ω one after I dug through the drawer and found one that tested a bit fat). R-12 would normally be an adjustable resistor set to 50 Ω; this is the reference value in the bridge made up of the 50 Ω input to your transceiver and the tuner/antenna combo.

When everything is on board and soldered up tight it's time to attach the various conductors that are needed to wire the thing together. The kit comes with a small amount of RG-174 mini 50 Ω coax to guide the RF on and off the circuit board. There wasn't enough to complete my installation, but it was available locally, so I was able to pick up more. If necessary you can order some from your favorite mail order supplier. Lay in a fair amount of it—it comes in handy. Make all the connections to the board while it is on the bench. I chose to use both positive and negative conductors for DC rather than rely on chassis ground for negative return. Leave the leads long so that they can be cut to length, tinned, and soldered up tight after they have been led to their locations and tied snugly into place. The manual suggests the *optional* placement of a fuse between the transceiver and its input to the board. This is not an option! Buy a fuse holder and *put it in*. I forget now and then to turn off the tuning bridge before transmitting. This is not good! With the fuse in place, though, there probably won't be any damage.

Well, have fun—I certainly did. After you have soldered up the last joint, take a few minutes to verify that everything is connected to its proper place. When first powering a new project I usually leave the cover off and keep a sharp eye out for those little telltale puffs of smoke or glowing wires that indicate a problem. With a project of this type you are not likely to encounter any, but if you do, don't worry. Nothing on this board is difficult to find locally (with the possible exception of R-12/13). If you inadvertently transmit into the bridge, even with the fuse protection, and it quits working, check out R-12; you've probably let the smoke out. Stick a 47 Ω fixed resistor in its place as previously mentioned and you're back in business. 73

NEVER SAY DIE

Continued from page 23

history? It is a war that cost more than WWII, Korea, and Vietnam combined. Hint…it's one we lost. One we lost in a big way. One that has brought about catastrophic changes in our country.

It's President Lyndon Johnson's War on Poverty. Welfare. Welfare mothers. Hey, it's *your* money your politicians are doling out. Over $5 trillion so far, with no end in sight.

When the government pays women welfare benefits equivalent to $12 an hour, two-and-a-half times the minimum wage, in New York and Washington, not to work, what do you think this does to wages in those areas? To be "entitled" to this largess at our expense the women have to have children…the more the better… no job, and no husband who's working.

In 39 states welfare benefits are equivalent to about $16,600 a year. In eight it's over $20,000.

I've already written about a woman with two children who is on welfare in my small New Hampshire town. Her food and apartment are provided, plus schooling for one child, complete with a paid driver to ferry the child to school and back every day. The woman is bitterly complaining that her welfare-provided cable TV only gives her two paid channels. Oh yes, her husband is working, but they are "separated." One of my ex-employees' wives gets $50 a week just to drive the child to school. A recent exposé on welfare showed a couple of women in Laconia (NH) sitting in their apartments getting fat on this same system. Work? And lose all those benefits? You've got to be kidding!

So we complain about the single mothers. We complain about the loss of family values that's turning out one generation after another of uneducated welfare mothers and their progeny with no incentive or skills to work. Compassion gone berserk, and to hell with the "survival of the fittest" concept. We're making sure that the least fit survive and proliferate, dragging us all down.

What can *you* do about this mess you've meekly let fester? Two things. First, we've got to stop Congress from making things worse. Second, we've got to get Congress to strike out the laws they've made that are screwing us up. My bumper sticker approach to this is to start with Green's NRA: Never Re-elect Anyone! Get those bribed (via lobbyists) scoundrels out of Washington. Let's build a whole new breed of one-term politicians.

But most important is to take a few days off from watching mind-numbing TV and educate yourself. There are some damned good books which will help you understand what's gone wrong with our school system, with the war on poverty, the war on drugs, our terrible so-called health-care system, our "correctional institutions," and so on. Hey, we have the potential for having a pretty good country, but it's going to take a lot of work by a lot of people to make it happen.

The multi-level marketing (chain-letter) approach will work for us. First you educate yourself. Then you get two or three other people started being educated. And they do the same for two or three more. The next thing you know, we'll have a movement.

Say, that's not a bad idea for rescuing amateur radio from what now seems like an inevitable doom. If we could get across the idea that every new ham has a responsibility to make sure that he or she elmers at least two new hams, and that each of those do the same, we'd start growing again and have at least a prayer of keeping our hobby going.

In addition to growing local ham clubs, I'd like to see local political action clubs (PACs) get going. Members would be encouraged to read a book and report on it at the next meeting. There are an awful lot of books out there, but only a small percentage of them are interesting and educational. By distributing the work of separating the wheat from the chaff, a group can easily do something that no one person could accomplish.

The same goes for ham clubs too. How about a club project to sort out all of the ham-oriented books and report on them at club meetings? I'd suggest the club buy the books for the club library and then have a couple of the members read each new book and report on it. If the club can organize the bulk buying of the top-notch books, they can pass along the normal discount to the members. For most books this runs around 40-50% off the list price, allowing club members to build first-rate technical libraries at a big saving.

The next thing you know some entrepreneur will start collecting the book reports and submit them to me for publication. And I'll pay for 'em. The resulting sale of the better books will help discourage publishers from unloading crap on us, and will encourage the writing of even better books.

How about it? What book having something to do with amateur radio, electronics, or communications have you read that was really exciting and outstanding? My $5 list of 73 "books you're crazy if you don't read" doesn't have any ham books, but that's because I haven't found any that are outstanding so far. My list does cover a wide variety of topics. Reading these books will beat the heck out of a college education. And be cheaper, and take a lot less time.

Perhaps I've let my idealism run away with me in even suggesting that we try to run our country on reason instead of fanaticism. Maybe screaming protesters and terrorism are the rule of the day and reason passé.

Anyway, if you feel that people who prefer not to work are worth $335 billion of your money being taken out of your paycheck every year, then go back and watch that ball game on TV, or get on the air and ask a few more hams what antenna they're using. As long as you're satisfied that you're getting your money's worth it's no problem.

Continued on page 37

Foxhunting Deluxe

A compact antenna switching unit for Doppler DF.

Breckinridge S. Smith K4CHE
104 Brookfield Drive
Dover DE 19901

I've been interested in Doppler DF systems for foxhunting for several years. No, let me rephrase that. I have been *obsessed* with Doppler DF systems. Ask my wife—she'll tell you. So when I read KØOV Joe Moell's "A Good Doppler Gets Better" in the April 1995 *73*, the antenna switching techniques got my attention. After all, if Joe uses two diodes to switch each antenna for his Doppler system instead of one, it has to be better, right?

I have never been satisfied with large VHF Doppler antenna systems that are mounted on the car roof. Most of these systems consist of a large plywood or aluminum plate with appendages to improve the ground plane. The switching circuits are usually mounted somewhere under the plane. On UHF the overall size is smaller and you have less wind loading, but on VHF the larger size can be hard to manage. I lost a large VHF array while driving during a hunt, and that cured me of temporarily mounting big heavy things on top of my car. When that Doppler antenna package became airborne it looked like a square flying saucer (and it barely missed wiping out the car behind me).

Joe KØOV then published his article "Wideband Doppler, Part 2" in the June 1995 *73* describing his modification of CB magnetic mounts and mounting the antenna switching circuits inside the Roanoke Doppler chassis inside his car. This looked like a better system since mag mounts have to be better than my flying saucer. I wasn't really happy with the CB mag mounts, but I decided to press on with the project, build the switcher, and shop around for a better magnetic mount antenna to modify.

The problem with putting the antenna switching circuit inside your system box in your cockpit is that you now have *four* long coax lines running across the roof and down inside the vehicle, over the seats, across the dash, etc. Trying to get these four long antenna feedlines electrically equal is next to impossible. Additionally, on two of the units I tested, these long feedlines appeared to couple to each other and cause reflections which affected the bearings. I decided to build a remote switcher so I could eliminate most of those feedlines. Since I already have several holes in my van roof (I told you I was a DF fanatic), I was able to put the four mag mounts near the hole and mount the new switcher box just inside the roof. That provided short feedlines, good decoupling from the antennas, and a neat installation.

***Photo A.** The Dick Smith Doppler unit is on the dash. K4CHE uses the DF for commercial stuck-mike hunting, etc., in Delaware.*

Circuit construction

The small switcher unit puzzled me for a while. On the KØOV dual diode switcher circuit the majority of the surface board is at a positive 3.7 volts DC potential, so it has to be isolated from ground. Joe solved the construction problem in his "Part Two" article by using a "Dremel Moto-Tool© as a router to insulate the center of the board where the four single-hole coax fittings mount."

So I built a remote-mounted switcher box using copper-clad board and used the same Dremel tool routing techniques. Basically, I used a double-sided PC board and cut it to fit the top of a standard Bud box. Using a double-sided board and a sealed box made the circuit

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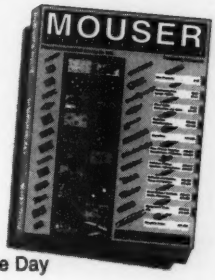

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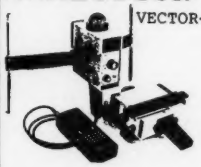

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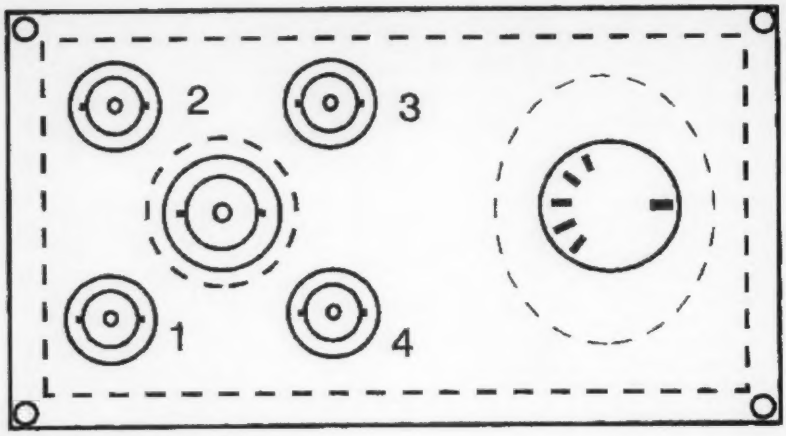

Fig. 1. Top view of the switcher.

well-shielded. BNC connectors reduced the board size and increased the connector reliability. Routing techniques were used to isolate the hot 3.7 volt area from the DIN connector. See **Fig. 2**. On most of my VHF/UHF projects I like to wind my own chokes to the frequency that I plan to use. Joe's directions for winding

"Do away with the octopus—eliminate the flying saucer with Doppler DF!"

the box case. These routed areas are indicated by the dashed lines in **Fig. 1**. The holes to mount the board to the aluminum box are drilled outside the routed areas and the DIN connector mount area is also isolated. The routed area is on both sides of the double-clad PC board. The center BNC connector for the receiver coax is isolated from the board inside its own dashed circle (routed) area. Use high quality Teflon™ BNC connectors so you can solder the nuts to keep them tight and have reliable connections. You will have to refer to Joe's schematic in his column "Homing In" in the April 1995 *73* to get the big picture. The component values are published in both the April and June (1995) issues of *73*.

The pin diodes all are mounted and connected between each antenna's BNC center pin and a small insulated standoff connection point. Remember that the cathode end goes to the insulated standoff connection point. The 680 pF RF coupling caps (C101-104) are then connected from the insulated standoff connection point to the pin of the center BNC to feed the receiver. Switching signals are supplied through the RF chokes (L101-104) which are connected between the pin diode/coupling cap standoffs and the choke input bypass capacitors (C105-108) and then a connection is made to the appropriate pin on the chokes using a 2 meter quarter-wave of wire (19.5 inches) are in the June 1995 issue.

I soldered the bottom of each choke input bypass capacitor by a short lead directly to the copper board and mounted these caps vertically on their ends. These vertically mounted bypass capacitors now serve as mounts for the other ends of the chokes as well as performing their bypassing function. See **Fig. 2**.

If you're careful you'll wind up with equal lead lengths on the coupling capacitors and the whole switching circuit will be symmetrical. When soldering your wires on the DIN connectors, remember that the pins are not in order and DIN pin labeled number 1 goes to antenna number 1, etc. Don't forget C109, which provides an RF path from the routed center receiver BNC mount area to the main board area. You might want to install and solder this capacitor first, as it may be hard to get to later. Choke L105, which provides the +3.7 volts to the main board "P" area, can be soldered last.

Magnetic mount modifications

My preference is the Motorola magnetic mount. It has a 1/8-inch rim that allows you to grasp it easily for removal. In addition, the mount is hollow in the center. The 1-1/4-inch hole in the center can be accessed by cutting through the plastic that covers the magnet's bottom. This large access hole makes it easy to modify the interior, and later on you can even change the feedline (after you've slammed the RG-58 feedlines in your door a hundred times).

Motorola provides different antenna whips that are cut for different frequency segments; the low split whip (see the Parts Resources at the end of this article) covers 144 to 152 MHz, with a center frequency of 148. I have used these precut antennas without any problems, even though the center frequency is a little high for the ham band. There are other brands of whip kits available that will fit the Motorola mount. Coverage of the entire amateur band and beyond can be accomplished with an Antenna Specialist quarter-wave kit (part number ASP695). This antenna comes with a .072 diameter whip that can be trimmed and the hardware threads are compatible with the Motorola mount. With this antenna kit you could use different lengths of piano wire whips for each VHF segment you want to cover.

Modifying the Motorola mount is easy. Cut a circle in the clear plastic bottom cover. Carefully and quickly unsolder the center conductor from the center pin, using a good-sized iron. Let the center insulation cool and then bend the center conductor away from the center pin and mount your pin diode from the center conductor to the center pin of the mount.

Then mount the 270-ohm resistor from the shield clamp to the center pin. Use a piece of tape for insulation under the diode and resistor. Using this construction technique you will wind up with very short resistor and diode leads, so it's easy to keep lead lengths the same length on all of the mounts. After the mag mount surgery is over, repair the access hole with mailing tape—the clear tape that is 2 inches wide. You might want to put on an additional layer of clear tape on the bottom of your mount to protect your car roof and to further insulate the mount from the vehicle. Remember, the ground portion of the mag mount is at a positive 3.7 volts.

Testing

I was worried about how much noise might be generated by the extra

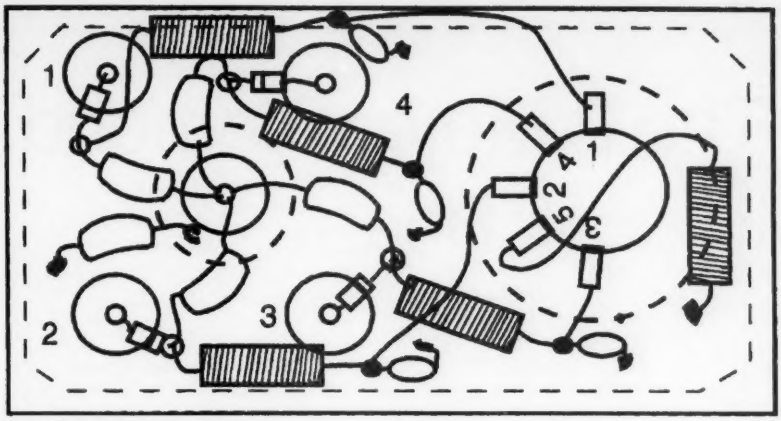

Fig. 2. Bottom view of switcher.

switching diodes, and their effect on the overall sensitivity of the system. After several tests out in the field I couldn't hear any noise increase due to the switching system with it mounted just inside the van cockpit, directly under the antennas.

Using my Dick Smith Doppler I mounted test connectors for the original switcher and the KØOV dual-diode circuit and ran comparison tests. With the dual-diode switching, the overall sensitivity of my Dick Smith Doppler system increased several microvolts. Additional tests with the Roanoke produced the same sensitivity and I could actually get some indication of stations that were well down in the noise. This was more evident on my Dick Smith system as it has 32 LEDs and appears to be more responsive visually to weak signal detection, as opposed to the 16 LEDs of my N6ZAV display. I know I will get a lot of comments about the 32 LEDs, but I like to see multipath to analyze it, and with the 32-LED display you get more information. In addition, with the 32-LED Dick Smith and the inherent "circling LED" you know when you are detecting a weak signal because the circling LED stops circling on a noisy weak signal and presents you with a multiple LED segment that just sort of jiggles back and forth, providing you with a rough direction indication.

When testing your mag mounts and remote switcher, a good troubleshooting hint furnished by KØOV is that you should have a couple of volts on each antenna (less than 3.7 volts due to the diode drop), and the voltages on each antenna should be equal if the diodes are OK. A 16-inch spacing seems to be best between each antenna, but Joe published "18 inches" in the June issue. With the mag mounts you can experiment with the spacing and reach your own conclusion. RF near-field testing with a 25-watt signal from two feet away did not blow any switching diodes.

Get out the Dremel tool; start routing. Now you can do away with those "octopus" leads that are strung across the seats and/or eliminate the flying saucer mounted on top of the vehicle. If you are new to Doppler, this system will solve the antenna dilemma. Many thanks to Sam K3BY who assisted in the testing and building of duplicate switching units and antennas. Good hunting.

References

Joe Moell, *73 Amateur Radio Today*, April 1995, page 68.

Joe Moell, *73 Amateur Radio Today*, June 1995, page 54.

Parts Resources

Diodes, chokes etc. are listed in the reference articles.

Motorola magnetic mounts can be ordered direct from the Motorola parts division at 1-800-422-4210. Motorola part number for the mag mount with 12 feet of RG-58 is 01-80355A91. Motorola part number for the lo-split whip (144-152 MHz not adjustable) and chrome base nut is 01-80352A06.

The Bud "Econoboxes" part number is CU-124 and can be ordered from Allied at 1-800-433-5700. Ask for Allied stock number 736-3600.

An Antenna Specialist whip kit that can be trimmed is manufacturer part number ASP695 and is available from Tessco, 1-800-472-7373. Ask for Tessco part number 94090. 73

The 2 Meter Diamond Beam

It could be a real gem in the rough.

Thomas M. Hart AD1B
54 Hermaine Ave.
Dedham MA 02026

While reading the ARRL *Antenna Compendium Volume 2*, I encountered an antenna design I hadn't seen before. In an attempt to minimize the footprint of horizontally polarized HF beams, G.A. Bird G4ZU used a linear driven element in conjunction with a director and a reflector bent at 90° angles. Refer to **Fig. 1** for more information about the diamond shape of the antenna.

A number of other experimenters have proposed variations of beam antennas without planar parallel element designs. In his book *HF Antennas for All Locations*, Les Moxon provides information on at least three beams featuring elements that are bent in a variety of angles. In the RSGB text *High Frequency Antenna Collection*, Erwin David G4LQI describes a two-element beam that features acute-angled elements. A final design that has been popular is the X-Beam described in the *Antenna Compendium Volume 1* and in the periodical literature. The tails on the X-Beam apparently contribute to the emphasis of front and rear lobes; a straight element X-Beam has four equal lobes (see the Moxon text for details).

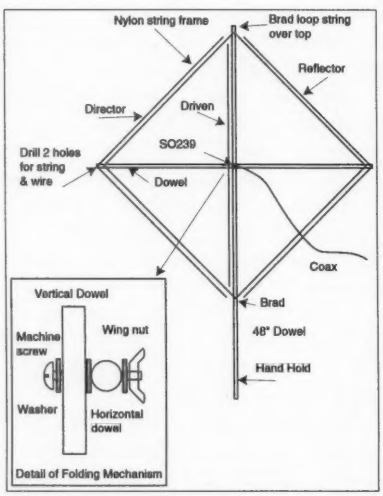

Fig. 1. Construction details for the 2 meter diamond beam.

After modifying the diamond design for 2 meters and switching to vertical polarization, I built a satisfactory three-element portable VHF beam. The entire contraption weighs little more than my Kenwood hand-held rig and is designed to fold into an easily transportable four-foot-long shape. I would not necessarily use it as a walking stick, but it is similar in size.

My intent was to build a 2m beam that could be used while hilltopping, traveling, or for emergencies. The beam must be light, easy to transport, and as compact as possible when not in use. Most importantly, construction has to be inexpensive. Moreover, three elements seemed to be the smallest design that would be of any real practical use.

Construction

By selecting 5/8-inch diameter wooden dowels for the frame and insulated wire for the elements, I was able to accommodate all of the basic requirements. Actual construction entailed the following steps:

1. Rough-cut a 38-inch long dipole, to be tuned to the center operating frequency desired by means of an SWR meter.

2. Tape the dipole to the top of a 48-inch dowel and carefully trim the ends until a 1:1 SWR is achieved. After finding the correct length, use a wood screw to fasten the SO-239 connector to the dowel. Use tape to hold the dipole against the wood.

3. Measure the length of the dipole and cut a director (95% of driven element) and a reflector (105% of driven element).

4. Cut a second dowel 2 inches longer than the driven element and mount it perpendicular to the vertical support using a machine screw, washers, and a wing nut. This arrangement allows the frame to be folded when not in use. Small brads are used at the top and bottom of the vertical dowel to hold the string framework in place. By making the horizontal brace 1/2 wavelength, the element spacing is 1/4 wavelength at the centers and the diamond shape is achieved.

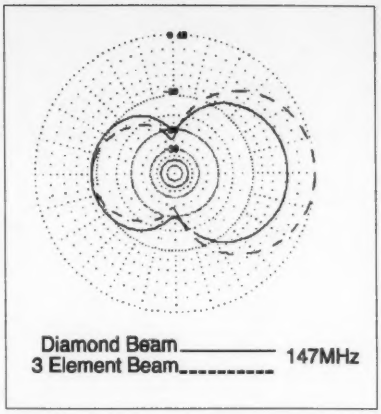

Fig. 2. Comparison of a traditionally-shaped commercial (MFJ three-element portable) antenna and the 2m diamond beam, using Eznec software.

"The beam is light, easy to transport, compact when not in use, and, most importantly, inexpensive to build."

5. Using nylon string, fasten the director and reflector into place, and use a spring-loaded clothespin for coax strain relief. When folded for transport, the top and bottom string supports are released from the brad. The wing nut permits quick tension relief for folding.

6. The final assembly step is to recheck the SWR; some additional trimming of the driven element will probably be necessary to overcome the effects of the parasitic elements. Cut the dipole in very small equal increments at both ends for best results.

Refer to **Fig. 1** for basic construction details. All components should be available at either Radio Shack™ or your local hardware store. I have been using a 40-inch piece of RG-8x to connect the antenna to my 2m rig. I used a Radio Shack 2m SWR meter to obtain the lowest possible SWR.

Testing

After completing the construction, I made some simple tests of the antenna and raised all the area repeaters without difficulty. More interesting was the fact that there were new simplex frequencies open for me to explore. I monitored the 147.21 repeater from Maine (which is often heard in the Boston area) and found that by turning the beam from side to side, I could change reception from 100% copy to inaudible, indicating reasonably good directivity.

I used Roy Lewellan's latest antenna software (Eznec) to compare the diamond antenna to a traditionally-shaped commercial beam. The results show that the diamond shape antenna is a perfectly viable alternative. I measured my MFJ three-element portable beam and loaded the element sizes into Eznec. I did the same for the diamond beam and compared the patterns of each (**Fig. 2**). Not surprisingly, the MFJ antenna has a sharper pattern to the sides and a better front-to-back ratio, but the diamond beam does surprisingly well for a package that weighs and costs only a fraction of the amount of a commercial antenna.

In conclusion, anyone in need of a simple 2m beam should review the available ham literature and decide if the diamond beam fits the bill. Read the original article by G4ZU in the *Antenna Compendium Volume 2*. At the end of the process, you will be hard pressed to find a simpler compromise antenna design than the diamond shape. 73

Oersted...Faraday...Tesla

Their discoveries created our worldwide system of electric power.

John W. Wagner W8AHB
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Ann Arbor MI 48103

The discoveries made by these three Giants of Electricity, perhaps more than any other scientific breakthrough since 1888, are responsible for advancing mankind as no other discovery has since Johannes Gutenberg invented the movable type printing press in 1453.

The early experimenters

Focusing on three is probably unfair to many others who also made significant contributions in electrical science. André-Marie Ampère (1775-1836), a mathematician, and Georg Simon Ohm (1788-1854), a schoolteacher, made truly significant contributions establishing the science of electrodynamics and electrical conduction, respectively. The properties of electromotive force in Ampère's time were in a constant state of interpretation and revision by many investigators; however, it was Ampère's brilliant deduction that solved the scientific riddle. Between 1820 and 1823, Ampère experimented with current-carrying conductors and reasoned that electromotive force is manifested by two kinds of effects: electric tension and electric current; thus, he established the concepts of voltage and current. Three years later Ohm defined the exact relationship between these two entities. Today, Ohm's Law remains the most basic and universally used of all laws in electrical science.

There were many others who made advancements, too numerous to mention in this short account; however, the names of Joseph Henry (1797-1878), James Clerk Maxwell (1831-1879), and Heinrich Hertz (1857-1894) stand out prominently. Henry, an American physicist experimenting with electromagnets in 1831, discovered *self-inductance*, a separate phenomenon of electromagnetic induction. Maxwell, a Scottish mathematical genius, established the laws of *electrodynamics* by formulating four fundamental equations defining the electromagnetic theory. He concluded that energy could be transmitted by electromagnetic waves at the speed of light. Hertz was convinced that Maxwell's mathematical postulates were correct, so he set out to interpret and prove Maxwell's work through experimentation. The experiments proved those postulates—that electromagnetic waves were indeed propagated in air at the speed of light.

In most long and arduous journeys into the unknown, interim breakthroughs are reached before the ultimate goal is achieved. The journeys traveled by Oersted, Faraday, and Tesla clearly illustrate this reality. In short, these men made those pivotal breakthroughs in electrical research that resulted in our worldwide system of electric power.

One thing is certain: The single characteristic most great scientists share is *insatiable curiosity*. Perhaps more often than not, luck plays an important role and a great discovery is made accidentally when the curiosity seeker simply stumbles upon an eternal principle—often try not to split doing so without realizing the significance of his discovery.

Thales of Miletus was one of the "seven wise men" of ancient Greece who lived some 2,500 years ago. In his search for the substance from which everything in nature is made, he accidentally discovered static electricity by rubbing a piece of amber with cloth, resulting in the amber attracting bits of feathers and the pith of plants. The discovery of the lodestone's magnetic attraction is another example of early "curiosities in nature" that ultimately led to present-day knowledge...a world these early curiosity seekers could not possibly envision.

It was not until many hundreds of years later that the next truly significant advancement was made. In 1453, Johannes Gutenberg changed civilization forever with his movable type printing press, a significant factor in the beginning of the Renaissance period that swept through Europe. The Renaissance is characterized as a rebirth in all forms of learning, including a revival of interest in the wisdom of the ancient world of the Near East and Greece. Two names from that period stand out as beacons lighting the way for others to follow:

"Without realizing it, Oersted had discovered the magic doorway that would ultimately lead to the age of electricity."

Galileo Galilei (1564-1642), an Italian; and William Gilbert (1544-1603), an English physician. They were the first to reject ancient thinking, which for hundreds of years had dominated man's knowledge of his world. Galileo is called the founder of modern experimental science. It was his bold defiance of ancient teachings that established the beginnings of the scientific method. He made his own telescopes, the largest available, and gathered much new information about the moon, stars, and planets. In addition, his experiments with the pendulum and falling bodies changed forever previously held beliefs adding greatly to the understanding of physics. In England, Gilbert's scientific study of the magnet culminated in a monumental

treatise entitled *De Magnete*. His quest was to improve the accuracy of the magnetic compass for better navigation on the seas and oceans. What he never realized was that he also laid the foundation of magnetic science, a key element that eventually led to the generation of electricity.

Pioneers in the age of electrostatics

Gradually, scientific investigators entered a period dominated by the study of electrostatics which was thought of as a curious phenomenon of nature with little or no practical value. The major thrust of scientific investigation during this period, as far back as Gilbert, still centered on improving the magnetic compass, although many independent investigators were working on the properties of conductivity. Charles A. Coulomb (1726-1806) was most prominent during this era because he established the fundamental laws of static electricity, and later made significant advancements in the manufacture of compass needles. Investigators became proficient at generating and instantly discharging static electricity, but they had no way of storing it. E. G. von Kleist and Pieter van Musschenbroeck bridged that gap in the early 18th century with their invention of the Leyden Jar, a capacitive device that could store static electricity for discharge later. It became a novelty item for royalty who took pleasure in shocking unsuspecting victims. It was all in good fun, but there was still no hint of where electrical investigation would eventually take mankind.

Then, in 1800, Alessandro Volta (1745-1827) made the first electrochemical cell and battery capable of producing continuous electric current. His inspiration came from Luigi Galvani (1737-1798), a physician who had been conducting experiments with frog legs hung on brass hooks. The legs convulsed when he touched a piece of iron to the framework. Galvani proposed a theory of "animal electricity" as the reason the frog legs had muscle spasms. Volta disproved this theory, stating accurately that the frog legs convulsed as a result of their being in contact with two different metals. His metal theory intrigued him, so he conducted numerous experiments. Eventually, Volta created a chemical cell capable of producing a continuous electric current. He assembled zinc disks alternately with silver disks, separated by pasteboard soaked in brine solution, and called it an "electric pile." No longer was static electricity the only form of electricity known to man; Volta's continuous current cell was indeed a milestone in the annals of discovery. It was Volta's chemical cell that truly put electricity on the move, and today the battery is still an important, although minor, source of electrical energy.

Michael Faraday worked diligently toward his goal until he achieved it. If Oersted discovered the magic doorway that would lead to the age of electric power, it was Faraday who unlocked that door. His public wondered what use could possibly come from producing a small current by moving a magnet near a length of wire...the Genie still needed to be tamed to become man's tireless servant. Faraday understood the far-reaching possibilities

"More often than not, luck plays an important role and a great discovery is made accidentally when the curiosity seeker simply stumbles upon an eternal principle."

Oersted

The next exciting event took place in 1820, in the classroom of a Danish professor named Hans Christian Oersted (1777-1851). He was conducting an experiment with one of his students, showing him how a wire could be heated when it is connected to a voltaic pile. Oersted had neglected to clear the table after his previous experiment, and a magnetic compass remained near the wire. When the connection was made to the voltaic pile, the compass needle turned and pointed toward the wire. At first, Oersted could not believe what he had seen, but ultimately he realized he had discovered something new: Electricity and magnetism were interrelated. He named this new force in nature *electromagnetism*. Without realizing it, Oersted had discovered the magic doorway that would ultimately lead to the age of electricity.

Michael Faraday

Michael Faraday (1791-1867) made the next giant step on the long road leading to modern-day electric power. The impetus that set him on his series of epoch-marking experiments was news of Oersted's discovery of electromagnetism. Faraday reasoned that if electricity produces magnetism, then why shouldn't magnetism produce electricity? Finally, in 1831, his experiments revealed a great truth: Electricity could indeed be produced by magnetism; however, the critical component of his discovery was that magnetism must be accompanied by motion. Unlike Oersted, who accidentally stumbled upon his discovery of electromagnetism, and is said to have replied, "What is the use of a new-born baby?" Further example of Faraday's wit has become English folklore. The Prime Minister is said to have asked him what use could be made of his discoveries. Faraday allegedly responded, "Someday it might be possible to tax them."

For the next 51 years, man struggled to increase the electrical output of Faraday's embryonic generator. His genius had shown the way; now it was up to engineers to make progressive refinements of his discovery. Volta's batteries had been used initially for electroplating metals, but they were large and very expensive. Gradually, engineering advancements in magneto-electric generators surfaced. Besides their use in the electroplating industry, these first generators were also used for powering arc lamps, lighthouses, and naval vessels. Arc lamps required DC, so a commutator was necessary for rectifying naturally-occurring AC. By 1872 the DC generator had reached its peak of refinement, and DC motors had also come into limited use, but they proved to be inefficient and troublesome, creating sparks and requiring frequent maintenance. In addition, DC power was inherently inferior due to its I^2R voltage loss, and could not be sent a distance greater than half a mile from the generating station. DC also required inordinately large cables to transmit the current, making it very expensive. Nevertheless, this was the only path man knew to follow.

In 1880, the Menlo Park group, headed by Thomas Edison, invented the first practical incandescent lamp, which was a much needed improvement over

the power-hungry and dangerous arc lamp. Edison, whose thirst for entrepreneurial conquests exceeded (or perhaps equaled) his popularity as an inventor, saw the opportunity to capitalize on the new incandescent lamp by using existing DC technology as a power source. He attracted investors to fund the construction of a power station in New York, and soon more DC power stations were built in America and abroad. Their existence proved to be a short–lived evolutionary trend, doomed to extinction due to their inherent inefficiency. DC power, even in its refined state, barely cracked the door to the awesome power contained in Faraday's Genie.

"In that instant, Tesla's brilliant mind conceived perhaps the most beautiful creation since the wheel; he called it the rotating magnetic field."

Tesla

Harnessing alternating current was deemed impossible by leading authorities, including the physics professor of a young engineering student in Austria named Nikola Tesla. His idea was the exact opposite of his professor's, and he set out to prove that AC could indeed be harnessed. Professor Poeschl and his classmates laughed at him, but he was undaunted. For two years Tesla went into a state of self-imposed exile, devoting his entire energy to solving the AC conundrum. He sensed that the answer was hidden in his mind and would eventually come forth, but the mental anguish he suffered during his search nearly killed him, so strong was his resolve. Then, in 1882, the solution came suddenly, in a blinding flash, as he recited poetry while walking in a park. In that instant, his brilliant mind conceived perhaps the most beautiful and ingenious scientific creation since the invention of the wheel. In a sense, it was very much like the wheel; he called it the *rotating magnetic field.*

Tesla's understanding of the awesome power contained in Faraday's Genie was clearer than any of his contemporaries could imagine. The problem of how to harness that energy to do the work of giants had dogged him for more than two years, and now he had discovered the final solution to make alternating current man's servant! The scientific community had always regarded AC as equal to a perpetual motion concept—utterly ridiculous! During Tesla's sudden burst of brilliance on that day in the park, he not only conceived the rotating magnetic field but an entire system of *polyphase AC* that has remained unchanged in principle to this day. Energy in the form of electric power could now be used in virtually unlimited amounts anywhere. His rotating magnetic field discovery, equal in importance to Oersted's and Faraday's pioneering achievements, is a principle of unfathomable beauty that will live forever. It stands today as the foundation on which our entire world operates. Indeed, the power of Faraday's Genie, captured by Tesla, was, and still is, the most important scientific discovery in more than 500 years. Tesla had not only opened Faraday's magic door, his polyphase system literally blew it off its hinges and took the entire wall with it.

Today, the world owes Oersted, Faraday, and Tesla a tremendous debt of gratitude, for it was their monumental discoveries in electrical science that gave us the power to run our factories, mills, schools, hospitals, research centers, stores, and homes.

Technological advances are happening at an ever increasing rate, and we seem always to be looking forward—which is good, but would it not also be uplifting to look back and acknowledge, even pay homage, to the pioneering spirit of those whose efforts laid the foundation for all the technological advantages we enjoy today? Our schoolbooks, teachers, and professors seldom mention these pioneers (if indeed they know anything of their existence). Further, many historians and book writers have elevated the names of entrepreneurs and technologists, crediting them with discoveries made by early pioneers, and if we are not more mindful, our historical heritage will be lost forever. 73

NEVER SAY DIE

Continued from page 29

One ham suggested a way to solve the deficit problem would be to fire the top three layers of management of all federal bureaus on the basis that it's unlikely that anyone lower down would notice much difference. Oh, the bureau's jet planes would get less use. But why not fire 'em down five levels and start reducing the deficit instead of just stopping its growth?

Oh yes, one more innovation. Since many of our more serious social problems have been caused by federal judges running amok, bypassing the legislative system, how about putting term limits on those rascals too? 73

Bioenergizer Update

Bob Beck called with some suggestions for researchers working with doctors toward the elimination of crud in the blood, as described in the lead article in May. Firstly, don't use any metal in contact with the skin, since even low levels of current can cause burns. Bob recommends that the electrodes be made of heavy wire cut one inch long, or perhaps a nail, wrapped with flannel. The flannel can be held in place with heavy thread. Then you soak the flannel in a saline solution to provide conductivity.

In my experience, if you don't get the electrodes exactly over the wrist veins and in line with them, you can still get some slight burns. They don't hurt, just itch. You can feel the throbbing when the electrodes are exactly in place. I use a 1-inch wide strip of elastic with hook-and-loop fastener on the ends to hold the electrodes in place on my wrist, and a second an inch farther up the arm to keep the wires from yanking the electrodes out while I'm working or typing.

Bob also recommends the use of a 100k pot instead of 1 meg to give better control of the voltage. And he says not to use more than three 9V batteries (27V). Though there have been no reported problems with heart pacers, there is the potential for such trouble, so the best bet for doctors researching this field would be to avoid pacer patients until more is known.

Bob is promising a media announcement of the results achieved with this procedure in the near future, which should make it easier for you to find doctors interested in this approach to dealing with AIDS and other blood-carried problems. I gather that eliminating the HIV virus doesn't take very long, but the rebuilding of the T-cells can take around 90 days.

If you want to learn more about AIDS I suggest you read the books by Duesberg, Douglass, Batmanghelidij, Comby, and Wallach. If you are more interested in misinformation, read your newspapers and watch TV. People *are* being saved, even from the last stages of AIDS.

Can the bioelectrifier also help people lose weight and regrow hair? Hey, get together with an interested doctor and you tell me. He doesn't have the electronic smarts to build the unit and you don't have his license to kill, so you need each other. Of course, that presupposes that you'll be able to find a doctor not totally indoctrinated with the semi-religious belief that AIDS is incurable.

My experience (and Bob's) with AIDS workers is that they get all upset over the prospect of a simple, inexpensive cure. I've had them scream at me in rage that AIDS is incurable, and then stalk away, just at the *suggestion* that this new approach should at least be tested.

But hey, with over 300,000 deaths yearly due to hospital error and negligence (according to a Nader study), what's a few thousand more deaths, right? Unless that's *you* being rolled into the hospital, of course. Well, the odds are about 10:1 that you're there because you haven't treated your body right, and the odds now are that the doctors aren't going to be a lot of help, but they and the hospital are going to make a ton of money. I served on the board of directors of our local hospital, so I've seen all this first hand. 73

Number 38 on your Feedback card

The MFJ-9406 6m SSB Transceiver

6 meters: The adventure begins.

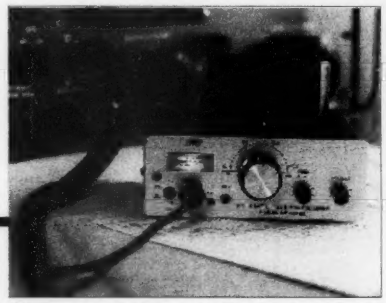

***Photo A.** The MFJ-9406. (Photo by Conard Murray WS4S.)*

Jeff Gold AC4HF
1751 Dry Creek Rd.
Cookeville TN 38501

There are large numbers of new hams entering the hobby with the no-code Technician license. Unfortunately, most of these people are limited to experiencing only one small aspect of ham radio. Many seem to get on 2 meters and talk on repeaters. They are allowed to operate SSB and CW (phone and code), but may not be aware of how much more fun they can have. I believe that the more these people are exposed to other aspects of the hobby, the more they will be motivated to upgrade.

I've had a blast with the MFJ 20 meter SSB rig. It's small, portable, and works *great!* I have used it for the University Ham Club's QRP Expedition and during many SSB contests. When MFJ announced it was coming out with a 6 meter version, I had to have one. With great expectations, I waited for my new 6 meter rig to arrive. One of the best things about ham radio is trying different aspects of the hobby. I was eager to try 6 meters.

My new toy finally arrived. I opened the box and took out the rig, with its matching microphone (my MFJ 20 meter rig's matching mike worked super so I'd decided to get one with this rig). I found a spare spot on top of my operating bench, which in itself was a small miracle, then I looked around on the floor and found the appropriate DC plug to match the rig. I *very* carefully checked the voltage and polarity before plugging it into the new rig. I have a wide variety of DC plugs and alligator clips that allow me to get power to about any type of equipment. I remembered reading that my Gap vertical was resonant on 6 meters so I hooked it to the rig.

How do I sound?

I pushed the red power button and the rig instantly came to life. I turned the main tuning knob and picked up a signal. Using the smaller fine–tune knob, I tuned in the voice until it came out clearly. The rig has plenty of audio to drive the built–in speaker. I had the volume up only a little way and it was more than loud enough. I heard Jay KE4NYH calling CQ for some type of contest. I've worked my share of HF contests both on CW and SSB, but hadn't worked a VHF contest yet.

"This rig is about as simple to operate as it gets—it takes all of about five seconds to get used to it."

I answered Jay's call and he immediately came back to me. He told me some strange letter combination, "EM65," and I gave him my name, QTH, and his signal report. I stopped him before he could give the standard contest good-bye to ask for a detailed report on how the rig sounded.

"Sounds real good, real good audio quality," Jay said.

I explained that I was testing out a new rig and he was my first contact. He said, "Hope my rig sounds as good as yours does." This was high praise coming from someone on a full powered base station transceiver.

I later spoke with Jim WA4SOH, a veteran 6 meter operator. He gave me a 10 over 9 report. "Not too shabby for using low power on a vertical," Jim said. "Good audio. Yours is the first MFJ 6 meter I have heard. You're doing well—I'm impressed."

I talked to Jim for a long time about the rig, the way it sounded, and about the 6 meter band in general. Jim runs a Kenwood 690 with a five–element Yagi. He later told me, "If I didn't own this Kenwood I would purchase the MFJ."

Another opinion

I also talked with the local 6 meter guru Conard Murray WS4S. We talked for quite a while and he also was impressed with the way the rig sounded. He helped me while I played with the processor level. I then changed to my 160 meter dipole using a manual antenna tuner. The receive signal went way up and so did my signal report. Conard talked to me about using a beam on 6 meters. I plan on getting a loop or a beam to increase my effective signal strength, but meanwhile I am having a lot of fun with the 160 meter dipole.

Conard talked me into letting him test out the rig for a while.

"Overall, I was very impressed with the radio,," Conard said. We discussed his impressions and findings. He found the rig to have good selectivity. "When you tune off a signal, it drops off and disappears. You can really separate out signals. The front end doesn't overload from very strong signals. The AGC (Automatic Gain Control) action on local signals is good. These signals sound natural and don't get distorted. The rig also has good sensitivity. If there is a signal in there, you should be able to hear it on this rig if you can hear it on a main station rig. It has good physical stability; you can bang on it, take it mobile or mountaintopping/portable and it

will handle the roughness. It makes an excellent starter rig for 6 meters and should be great for new or old hams. It also makes a fine portable rig and you should be able to run it for a good while off a gel cell."

Lots of assets

Operation is about as simple as it gets. There is an on/off push–button in the lower left corner, right under a combined S-Meter/Processor output meter. Next to the on/off button is the mike jack, then the transmit on LED. There is also a key jack for the optional Semi-QSK CW module that will be out soon (I can't wait to test it). There is a large tuning knob in the middle of the front panel, next to a smaller fine–tuning knob and an audio volume control. It takes all of about five seconds to get used to the rig.

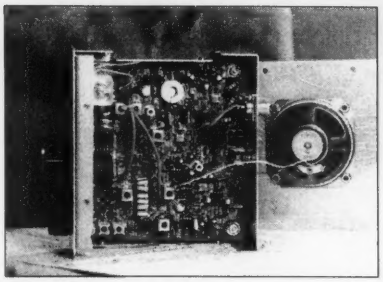

Photo B. Inside this 6m rig. (Photo by Conard Murray WS4S.)

"Plenty of audio to drive the built-in speaker—I had the volume up only a little way and it was more than loud enough."

On the back panel is the mike gain control, the 12-14 VDC power jack, and the SO-239 jack. There is also an external amplifier jack that uses a solid-state FET switch to key an amplifier, such as the Mirage A-1015-G.

The rig is small and rugged; it has low current drain and can operate on a D-cell NiCd pack or a small gel cell. Operating from the home, it will work with any 2A AC supply.

I didn't notice any drift after leaving the rig on for a while, and I was impressed with how natural the other operators sounded on it. The selectivity seemed good. It has a 2.3 kHz HF-style SSB ladder filter that reduces passband noise, helps to fight some of the QRM, and works on getting some of the weaker signals to come through and be understood.

The transmitter puts out 10 watts PEP. It has a Constant Current™ syllabic speech processor that MFJ claims gives an added 4-6 dB advantage to help cut through noise. I'm not one to dwell on technical specifications, but rather on how well things actually work. The 20 meter MFJ rig and this one both do *very* well with the amount of power put out, so I guess I believe that the processor works. I have had operators who were working high-rate HF contests stop and tell me how good the 20 meter version sounded.

The 6 meter band seems to have a personality all its own. There are times when it is totally quiet; other times you can work good distances with very low power. I think this new MFJ rig is a terrific way to try out a new band without investing a fortune. I am very pleased with it. 73

Manufacturer's Specifications

Receiver Station

Frequency coverage: 50.000-50.3000 MHz
Receiver type: Single–conversion superhet
Frequency control: Heterodyne VF, low–side injection
IF frequency: 10 MHz
IF selectivity: -6 dB @ 2.5 kHz
AGC: Audio–derived, 70–dB dynamic range
Sensitivity: .15 µV for 12 dB S/N
Audio: 1 watt into 8 ohms at 10% THD
Average Rx current: 60 mA (S-meter lamp disabled)

Transmitter Section

RF power output: 10 watts PEP
VSWR tolerance 3:1 VSWR maximum
Peak Tx current: 2.0A
Speech enhancement: RF compression, syllabic rate
Spurious attenuation: 60 dB
CW generation: 600 Hz tone (with optional installed)
Mike input: 600 ohms dynamic

CARR'S CORNER

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This month we're going to take a look at some recently-announced ham products, and answer a question or two from the mail bag. First the stuff:

Ameritron AL-800H amplifier

It seems that there is another pair of "loudenboomers" on the market (**Photo A**). A recent news release from MFJ Enterprises, Inc. [P.O. Box 494, Mississippi State, MS 39762; (voice) 601-323-5869; (FAX) 601-323-6551] announced the Ameritron AL-800H linear amplifier for the high frequency ham bands. It is rated at what MFJ calls "1,500 watts plus."

The list price is $2,295, which, given the price of everything else these days isn't terribly bad (you ought to see the price of the "645" medium format camera I recently looked at—errr...pined over—it makes the AL-800H look cheap).

There are actually two models of the AL-800 amplifier. The straight AL-800 uses a single Eimac 3CX800A7 power amplifier tube, and runs to powers up to 1,250 watts. The addition of the "H" suffix, to make the model number AL-800H, means that the amplifier uses a pair of Eimac 3CX800A7 power amplifier tubes, at powers of 1,500-watts-plus. The AL-800 and AL-800H are designed for legal operation over the range of 160 meter and 10 meter bands.

The AL-800/AL-800H feature a tuned input circuit, output network, tube protection (those Eimac 3CX800A7 power amplifier tubes are pricey!), Automatic Load Control (ALC), vernier reduction drives for tuning, a heavy-duty power supply (particularly important in power amplifiers), and a Step-Start Inrush Protection™ program (means longer life for those expensive bottles).

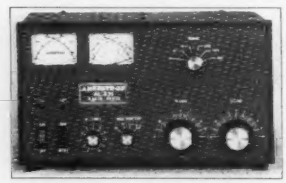

Photo A. *The AL-800/AL-800H linear amplifier.*

The tuned input circuit is an adjustable slug-tuned input circuit, which is common practice on HF linear amplifiers. The output network is the π/π-L design, which is claimed to provide smoother tuning and a wide impedance matching range.

The AL-800/AL-800H also have a grid circuit that limits grid current and thereby protects the tubes. Again, the Eimac 3CX800A7 power amplifier tubes are a major contributor to the price tag of linear amplifiers, so any protection is well warranted (grid current violations are major murderers of RF power tubes—I whacked my share of 6146B, 807, 1625, 813 and an occasional 4-400A in my misspent youth when I didn't understand grid current and overdrive!).

"Grid current violations are major murderers of RF power tubes"

The illuminated front-panel meters use the popular cross-needle design. These meters read peak forward power, reflected power, VSWR, high voltage, grid current and DC plate current.

The power supply of these linear amplifiers can be set for operation over 90 to 140 VAC, or 200-250 VAC; 14 settings of the AC primary voltage are possible. My own prejudice, by the way, calls for operation of kilowatt-and-up RF power amplifiers from the 220-VAC line. It requires a special outlet (of the sort that electric clothes dryers use, but not necessarily as many amperes (my linear amplifier is connected to a 220-VAC 20-ampere line that is dedicated to only the linear amplifier).

For information, call MFJ (as above), or Ameritron (116 Willow Road, Starkville MS 39759) directly at (601) 323-8211, or order direct at 1-800-647-1800.

Cross-Needle SWR/Wattmeters

The other product line we'll look at this month is also from MFJ Enterprises, Inc. These products are RF wattmeter/VSWR meter units (**Photo B**). These units cover 1.8-60 MHz, 144 MHz and 440 MHz, for a price as low as $69.95. The MFJ-864 features separate HF and VHF/UHF directional couplers (the heart of most such meters), and each is equipped with its own SO-239 RF connectors. It has two power ranges, 30/300 watts forward, and 6/60 watts reflected. The MFJ-862 is a VHF/UHF version with the same power ranges, while the MFJ-860 covers on the 1.8 to 60 MHz bands.

MFJ offers their "one year no matter what" warranty on these units—given what some guys do to VSWR meters, that's pretty generous!

Photo B. *MFJ-800-series RF wattmeter/VSWR meters.*

Now for the nonsense

First, let me state flatly that I only respond to polite business-like letters. The guy who, in December 1995, told me that my ancestry was suspect because I am a ham operator, didn't receive a reply...he's the same one who enlightened me with the blurb "...a 'ham' is half a pig's (yes, you know the word)." Sorry, dude, no cigar!

And the rest of the mailbag

I received two delayed letters on my series on vertical antennas. One of them asked whether the dimensions are the same for a ground-mounted quarter-wavelength vertical antenna as for a vertical antenna mounted on a tall pipe. The answer is: Not usually. As with so many things about antennas, the answer is a tentative "maybe yes, maybe no." I've put up a lot of verticals over the years; some of them were store-bought and some of them were home-brew. I've noticed that a slight variation in lengths is necessary, depending on where the antenna is mounted. I suspect that interaction with the local environment is the cause. But I've also noticed that the difference isn't always too great, and the resultant VSWR can be "tuned out" with a decent tuner. Still, install the vertical so you can adjust the lengths until the thing works right (Hint: Don't tighten the metal clamps until you finish adjusting it).

The other mailbag question about verticals arrived by Internet (see address below). The reader asked the value of the feed point impedance of the vertical. Again, the answer is a tentative "maybe...." The nominal impedance is 37 ohms (or as one purist chastised me, 36.6 ohms), and is therefore not a bad match for 52-ohm coaxial cable. But real verticals—you know, those messy things that we really have to put into or onto the air—are different. The feed point impedance will vary from a few ohms (like 2-3) up to the maximum. As a result, some companies offer multi-impedance broadband RF transformers that will help you match the actual impedance to 52-ohm coaxial cable. I've used the Palomar Engineers transformers, and have built 9:1 and 16:1 transformers following the directions given in the *ARRL Antenna Handbook*.

I've received several nice letters and E-mail messages on the twin-lead antenna discussed here a few months ago (and yes, the ends of the twin-lead *are* shorted!). Unfortunately, I didn't invent the antenna and can't take credit for it. I saw one for the first time in the late 1950s, late one night (actually, in the wee hours

of the morning) when a bunch of young hams went over to see a radio engineer from "Voice of America" who had just gone off duty. He told me that he'd found it in Bill Orr's (W6SAI) *Radio Handbook*. Bill, by the way, was my hero when I was a lot younger, and was the ham writer I most wanted to be like.

Connections...

I can be reached at P.O. Box 1099, Falls Church VA 22041, or via Internet E-mail at carrjj@aol.com. I am always glad to receive comments and requests, and will answer as many letters as I have time for...and that usually means all of them. 73

Number 41 on your Feedback card

HAMS WITH CLASS

Carole Perry WB2MGP
Media Mentors Inc.
P.O. Box 131646
Staten Island NY 10313-0006

"Young Ham of the Year"

In the spring of 1990, an event took place which was to be a highlight of my teaching career, as well as being a highlight in a student's life. Mary Alestra KB2IGG, a seventh grader at the time, won the "Young Ham of The Year" award.

Corporate underwriting for this award program is traditionally supplied by Yaesu U.S.A. Corporation and *CQ Magazine*. This year the youngster who is chosen as 1996 "Young Ham of The Year" will get the chance to know what it's like to train to become an astronaut. The winner will be treated to Spacecamp in Huntsville, Alabama, in addition to other prizes supplied by Yaesu U.S.A. and *Newsline*. *CQ* publisher Richard Ross K2MGA says, "As we enter our second year as co-sponsor of this award program, we are expanding our participation to include a week at Spacecamp. Our nation has a growing need for well-trained scientists and engineers; even if they don't become astronauts, the Spacecamp experience can help young people get started towards technical careers."

"Mary's love of radio was obvious, and her dedication to helping other children was impressive."

Mary was one of the most articulate young adults who had ever come through my amateur radio program. Her love of radio was obvious, and her dedication to helping other children was impressive. She seemed like the perfect choice to nominate for the award. The entire school took pride in her nomination. You can imagine how excited we all were when Mary was notified that she had won.

When a youngster receives national recognition, it has a big impact on his or her life. As you read about the qualifications for this award think about deserving young people you might want to nominate.

The "Young Ham of The Year" Award program was conceived in 1985 by then *Westlink Report* newsletter Editor-in-Chief Bill Pasternak WA6ITF. His desire was (and still is) to highlight the accomplishments of the nation's many young radio hobbyists, and to encourage the involvement of more young people in the exciting, rewarding hobby of amateur radio.

The young winner will also receive an expense-paid trip to the Huntsville Hamfest, where the award plaque will be presented at the Grand Banquet, along with a special prize in the form of ham radio equipment. The trip and the radio are courtesy of Yaesu, and the plaque is provided by *Newsline*.

The "Young Ham of The Year" award is presented annually to a United States licensed ham who is 18 years of age or younger and who has provided outstanding service to the nation, his/her community, or the betterment of the state of the art in communications through amateur radio.

All nominations must be submitted before June 30, 1996, on an official application form. Applications are available by sending a self–addressed stamped envelope to: The 1996 "Young Ham of The Year" Award c/o *Newsline*, 28197 Robin Avenue, Saugus, California 91350. The nominating applications are also available for electronic download from several sites that provide *Newsline* materials over the World Wide Web and from the general interest ham radio files area on America On Line (AOL Ham Radio Club BBS-Software Exchange-General Interest Files).

Bill and I agree that the real spirit of this wonderful award is to highlight a young person who has done more than just pass a license exam. We're always on the lookout for the young adult dedicated to the fellowship and service that is vital to the preservation of amateur radio. Good luck with your nominations.

For more information contact: Bill Pasternak (805) 296-7180. 73

Make a MICOR Into a Repeater

A simple modification using a popular mobile radio.

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After our club had a few repeater failures we ended up using two Kenwood mobile rigs as the repeater, one as the receiver and the other as the transmitter. Ham mobile rigs can do just fine as repeaters in a quiet RF environment with a good duplexer, but mobile rigs aren't really designed for heavy-duty repeater applications or for use at a high RF level repeater site. We were looking for replacement equipment when we spotted an ad by Versatel Communications in this magazine. They were advertising $99 Motorola MICOR 45 watt mobile radios which could be converted into repeaters, so we called for further information.

I talked with Versatel's head technician and everything sounded pretty good, so we took the plunge. To save time, and since we didn't have a Motorola test set handy, we ordered the radio with crystals installed and tuned, the repeater conversion instruction manual, and a conversion parts kit. All we would have to do were a few minor wiring modifications. The total cost with our options and shipping was less than $200.

The radio arrived in a month, with all items as advertised. After reading the instructions through a couple of times, we were ready to begin surgery. The modifications required were: (1) modifying the receiver RF connection; (2) strapping the receiver and transmitter channel selection (the control head would normally do this); (3) adding a small perf board with a couple of pots to act as a substitute volume and squelch control (again, the control head would normally do this); (4) minor modifications to the radio's power switching circuitry to allow full duplex operation; (5) interface to a controller (bringing the mike, PTT, receiver audio and COS signals out via a cable or connector).

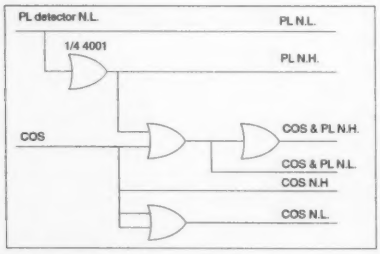


Fig. 1. The CMOS gate wiring.

Photo A shows the mobile rig with the top cover removed, as viewed from the rear. As you can see, it is assembled with modules; the transmitter strip is on the left side, the interface and connector board is the narrow strip in the center, and the receiver is on the right side. Each module has an RF shield (except for the one which we removed during modification of the audio/squelch board and lost). The SO-239 bulkhead connectors, Cinch-Jones power connector, and DB-9 controller interface connector are our modifications on the rear panel.

The transmitter strip is well-suited for ham repeater operation, as the whole transmitter side of the radio is an extruded heat sink. Although the transmitter is rated at 45 watts, we planned to run only about 25 watts, so there should be plenty of margin for repeater duty, especially when adding an external cooling fan as we have done.

Since the radio is a mobile unit, it normally switches the antenna connection between receiver and transmitter through a relay. Part of the conversion to make the radio full duplex is bringing out the transmitter and receiver antenna connections to individual connectors. Versatel's instructions call for the receiver RF connection to be brought to the rear panel, with the transmitter still using the existing relay for the transmitter connection (which is at the front of the radio).

"The transmitter strip is well-suited for ham repeater operation, as the whole transmitter side of the radio is an extruded heat sink."

Photo B shows the bottom of the radio viewed from the front. We made some changes in Versatel's suggested wiring. This photo shows that our modifications brought out both the receiver and transmitter antenna connections to the rear panel, along with the power and controller interface connectors. The radio's original antenna connection can be seen at the very left front of the radio, with the key lock just to the right of the connector. We disconnected the DC wiring to the antenna relay to save a little power, since the relay is now unused. To bring out the transmitter connection you will need an RCA jack and a piece of coax (RG-58 or similar) appropriate for the transmitter power level. Unscrew the output filter assembly located at the front top of the transmitter strip (it's labeled TFD6101A in the lower left-hand corner, in **Photo B**) to route the cable and RCA plug to the transmitter output jack, then reconnect the filter.

The radio we received had some

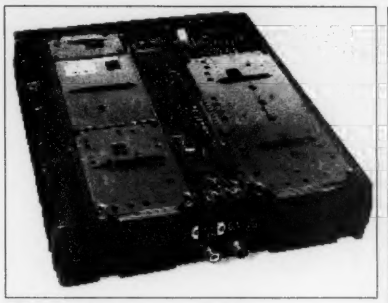


***Photo A.** Top cover removed.*

surface corrosion along the rear panel. This was not unexpected for something that may have spent the last 10 or 15 years in the trunk of a taxi cab or a truck. A little sandblasting and paint made the panel look like new. We then used a punch to form the RF bulkhead connector holes, and a nibbler tool to make the openings for the power connector and DB-9 connector.

The modifications, suggested by Versatel, also call for an audio/squelch pot board to be installed in the radio; normally a control head would provide these functions. In **Photo A** you can see the small piece of perf board and the components at the far top end, mounted with double-sided tape to the radio's interconnection board. Also, a speaker load resistor is visible slightly to the right of the perf board. **Photo C** shows the detail of these two items. In **Photo B**, a small Radio Shack™ speaker is double-sided taped to a metal divider inside the audio/squelch compartment.

Versatel's instruction manual shows the COS signal to the repeater controller being picked from their "Point H" (pin 12 of the audio/squelch board connector), but this is the output of an analog detector and is not a clean logic signal. I recommend taking the COS from pin 10 of IC202. The instruction manual supplied by Versatel is good from a modular level, but there is not enough detail for this mod to be made unless you have a complete manual. For those who don't have and can't find one, IC202 is one of only two chips on the audio/squelch board, and it is the one located closest to the interface connector pins. Pin 10 of IC202 is also routed to pin 8 of the interface connector pins, and our wiring to that pin can be seen in **Photo C**. The COS signal at this point is 0 volts unsquelched and 6.9 volts squelched.

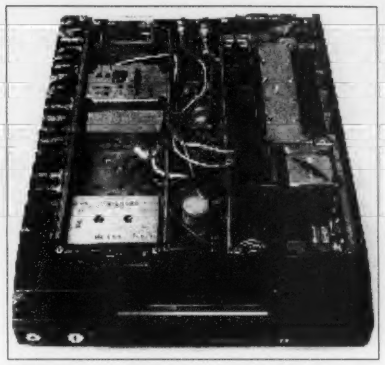


***Photo B.** And here's the bottom. The messy part is our added wiring.*

In addition to bringing the COS signal out to the controller interface connector, we also added a Motorola PL (CTCSS) decoder, and routed the PL decoder detector output along with the COS signal to a CMOS 4001 gate. The gate is wired as shown in **Fig. 1**, and provides us with the ability on the interface connector to use any of three squelch signals for the controller: COS only, PL only, or COS and PL ANDed from the 4001. And, with the single 4001 chip, any squelch signal can be either normally high or low.

Why would we use PL and COS ANDed? This radio uses resonant reeds to detect the CTCSS signal. These reeds have both a start-up decode delay time and a shutdown delay time. By anding the PL and COS, the shutdown delay time is eliminated from the composite signal.

Photo D shows the 4001 attached with double-sided tape and the nest of wires attached to it. Pin 7 of the chip is bent over and soldered to the small lug rising through the PC board, and pin 14 is folded over and soldered to the trace marked as REG+ on the board. The PL decoder output is picked off from pin 3 of the PL board, which would be the third in-line pin closest to the audio amplifier connections of the audio/squelch board. If you have the PL board, you'll know where to connect from this.

Alternate wiring

You can order these radios with a control head and cable. All of the modifications except RF cable routing and duplex power switching can be performed inside the control head, or you can discard the control head and just use the appropriate wires from the control head's cable for controller interfacing.

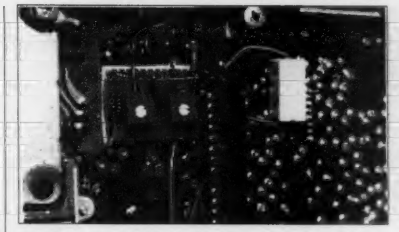


***Photo C.** The audio/squelch board we added. This is normally in the control head.*

If your controller requires switched audio, then you could accomplish this several ways. The COS from where we took it provides a clean logic level which can be used to drive an analog gate or (gulp!) a relay. The Motorola audio/squelch board in the MICOR includes squelch driven shunt switches inside IC202 that could also be used to ground the low level audio. A full manual would be handy for this mod.

Summary

What we got from Versatel was exactly as advertised. The rig was crystalled and tuned and the instructions were simple and clear. The radio has worked fine from its first day of installation.

On the downside, the included schematics are a little hard to read in some places, and a better copier or non-reduced copy from Versatel would help. It would also be nice to have more schematics of the circuitry itself. Then again, if we looked hard enough we could probably get a manual from a local radio shop.

Overall, we would rate Versatel's conversion package an eight out of 10. The Motorola MICOR mobile makes a great repeater, and for a couple of hundred bucks, you just can't go wrong. If you have a MICOR from another source, Versatel will also sell the conversion instructions alone. 73

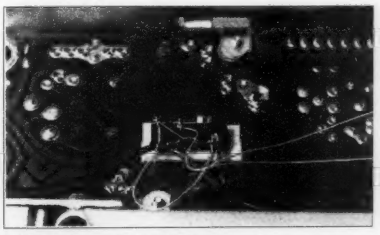


***Photo D.** CTSS CMOS gate.*

The ANC-4 Antenna Noise Canceller from JPS

Reduce that noise!

Pete Ferrand WB2QLL
65 Atherton Avenue
Nashua NH 03060-1904
pferrand@scoot.netis.com

The use of phasing to get rid of noise is common with microphones. The ANC-4 uses the phasing technique to get rid of noise before it gets to the antenna input of your radio. It's not an audio filter or a digital signal processor. The ANC-4 is connected between your normal antenna and your transceiver or receiver. Thus, when the ANC-4 knocks out noise, the noise never gets into your radio, so the receiving circuits have less to do and aren't overwhelmed by all that noise. The ANC-4 does its phasing by using a separate antenna to pick up the noise; that signal cancels out the noise you're listening to from your regular antenna.

First, set up the ANC-4 so the noise is picked up at the same or greater level from its noise antenna as it is with your regular antenna. Second, adjust the ANC-4's phasing controls until the noise disappears. If the noise doesn't null out, use the "phase range" and "freq range" buttons to increase the range of the phase shifter network.

The "gain" and "phase" controls interact some, so it's a good idea to watch the radio's S-meter closely and set the radio AGC to "fast." It's not a hair-trigger adjustment and the noise null increases smoothly as you approach the correct point. Settings will normally not need to be changed as you tune across the band, but they will need to be changed if the noise changes.

How does it work? Simple—the noise signals from both antennas are combined. Your adjustments have caused these two signals to have equal amplitude and opposite polarity (a 180-degree phase difference). Some types of noise are easier to cancel than others. The unit is designed to deal with locally generated noise, since all noises present constantly changing phase relationships when propagated over a distance.

The other requirement is that the noise antenna must hear the noise. The ANC-4 is provided with a telescoping whip, which works fine for most power line and computer noises you may have around the house. If the noise that bothers you can't be heard on the whip, there's a phono plug in the rear for attaching another antenna which can be positioned so it does pick up the noise. This may be a wire run into the engine compartment, if you're trying to defeat mobile ignition noise, or an outside dipole with polarization adjustable to match the noise, or perhaps a wire running parallel to your shack's power lines.

"I was able to get 40 dB of noise reduction on computers, broken streetlights, and power line noise."

I was able to get 40 dB of noise reduction on computers, broken streetlights, and power line noise—including line noise hereabouts that sometimes wipes out an FM broadcast station a mile away. It also works on household stuff like light dimmers, microwave ovens, and TV set horizontal oscillators. By careful operation, it's also possible to null local radio transmitters, such as broadcast stations.

You can't get rid of any signal subject to multiple modes of propagation. That basically means signals beyond ground wave. I discovered that some local noises change. For instance, a video monitor's signal can be perfectly nulled, only to have the noise reappear when the image on the monitor changes. You can only null one single noise at a time. I found that getting rid of the loudest noise source makes it easier to hear other noises! Discouraging, but that's life and those noises were there screwing up my listening pleasure anyway. Of course, I could get a second ANC-4...

Other features include an internal switch that bypasses the unit automatically when you transmit through it, so you can use it with a transceiver as long as it puts out 150 watts PEP or less. If you use a linear, simply locate the ANC-4 in the antenna line between the linear and transceiver. Lastly, by using just the noise amp and the whip, with no main antenna, you can use it as an active antenna.

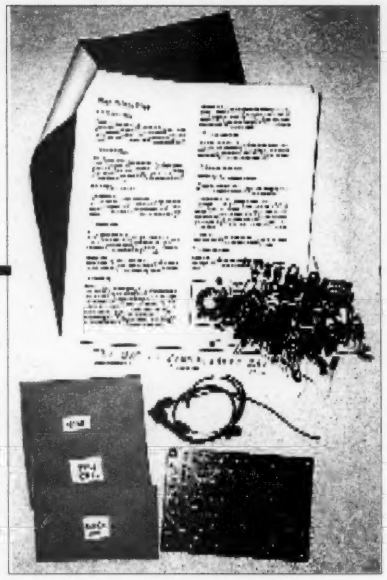
My conclusion is that the ANC-4 is definitely worth having if you have noise problems. It is not a replacement for an audio filter or a DSP unit—absolutely not. To deal with heterodynes, band noise, static crashes, and adjacent signal splatter you need DSP and audio filtering.

The times I'm most grateful for the ANC-4 are when I'm listening to my receiver, something starts up down the street and the S-meter swings over 20 over 9...a few adjustments to the ANC-4 and I can hear the station again. The ANC-4 ($176 retail) is manufactured by JPS Communications, P.O. Box 97757, Raleigh NC 27624. Telephone (919) 790-1048, (800) 533-3819 or FAX (919) 790-1456. 73

73 Review

The Green Mountain GM-20 QRP

Another small wonder!



Marshall G. Emm AAØXI/VK5FN
2460 S. Moline Way
Aurora CO 80014

One of the attractions of QRP operation (5 watts of RF power or less) is the wealth of excellent equipment that is available in kit form, at reasonable prices. The latest super rig may have more bells and whistles than the theater organ at Radio City Music Hall, but it will cost as much as a large car or a small house. Meanwhile, if you are prepared to avoid causing QRM and TVI and accept the challenge and excitement of QRP operating, there are some excellent single-band CW transceiver kits available for less than $100!

A steady stream of new QRP kit rigs has appeared over the last few years, so when a new one is announced by one of the Godfathers of QRP design, it gets a lot of attention. Such is the case with Dave Benson's (NN1G) new Green Mountain single-band CW transceivers for 40, 30, 20, 17, and 15 meters.

The Green Mountain series is a "lateral descendent" of the Small Wonder (or "40-40") series and the NN1G Mark III ('95 *ARRL Handbook*) transceivers. The main distinguishing feature in the new line is a separate heterodyne local oscillator, which adds a bit of complexity, but really helps on the higher bands. The transmitter drive has been beefed up with an MMIC embedded in the bandpass filter, providing 12 dB gain to the driver, and the final output is adjustable from 0.5W to a solid 3W. In the 20 meter version, the second harmonic is down 34 dB and spurs are down about 50 dB, at full power. Now that's *clean!*

The rig also features full break-in (QSK) via the familiar FET switch popularized by W7EL, and the receiver has incremental tuning (RIT) via a quad analog switching IC. A four-pole crystal filter on the 8 MHz IF sets the received bandwidth at 700-800 Hz.

Apart from the separate LO section, the receiver and audio output sections are pretty much standard for QRP rigs, but with an MC1350 IF amp providing 30 dB gain and a high level of stability. Sensitivity is right up there with the big rigs; minimum detectable signal is quoted at .1 µV (-126 dBm), and, in practice, you're limited to the ambient atmospheric RF noise level. These are *hot* little receivers!

"The instructions for winding the 13 toroids, often a real bugbear for kit builders, are some of the best I've seen."

It's available as a board kit (printed circuit board, all board-mounted parts, and instruction manual) for $75 postpaid, so you get the fun of building a well-designed kit which, after an hour or so, you'll turn into a real fun machine.

Construction

Your first pleasant surprise comes when you open the package from Small Wonder. The board is nicely done, double-sided and solder-masked, and the components are all new and of high quality. Several small groups of components are packaged in separate envelopes to avoid confusion, and the manual is a pleasure to read.

Small Wonder's philosophy is to encourage you to understand what you are doing. The manual includes a detailed description of the circuit components and trouble-shooting instructions, but it does assume a reasonable level of skill on your part. You don't get step-by-step Heathkit-like instructions telling you how to identify a 2.2k resistor and where to put it; the instruction steps are things like, "Install all of the board mounted components for the Local Oscillator as per the diagram below," or, "Wind and install all of the toroids in accordance with Table 1." For most of us, that's plenty. The silk-screened parts overlay on the circuit board and the parts list are all you should need and you can do it in whatever order suits you. However, the tips shown in the sidebar may be helpful and the instructions for winding the *13* toroids, often a real bugbear for kit builders, are some of the best I've seen.

An interesting approach is to have you build, test, and partially align the heterodyne local oscillator stage first. RF voltages are measured with an oscilloscope, but if you don't have one you can open the supplied "test circuit" envelope and build yourself an RF probe for your digital voltmeter. Getting this stage built and aligned insures that you are on the right track with your soldering techniques, and gives you a known starting point for the final testing and alignment.

This is a board kit, but turning the finished board into a finished rig in a box isn't difficult. All off-board connections (except a short link of coaxial cable for the antenna) are made via pin connectors. The wiring harness, with mating connectors already wired and color-coded, is provided in the kit.

Alignment and testing

You'll need some additional components in order to wire up the board for alignment and testing. They're available at your local Radio Shack™ or from any mail order parts house, and should set you back about 10 to 15 dollars, not counting the box:

10k gain pot (audio taper)
100k main tuning pot
5k RIT pot
SPST RIT switch
Key jack (RCA or 1/4")
Headphone jack (2.5mm or 1/4", your choice)
Antenna jack (SO239 or BNC)
A power connector (and .75A fuse)

I used a combination audio gain pot and power switch, and connected a power-on LED. I also used a DPDT switch for the RIT so I could switch 12V to an RIT-on LED. For power, I run red and black wires through a grommeted hole to a Molex-type connector (RS 274-222) via an in-line fuse holder (in the positive line). It's a good idea to wire everything up on the bench so you can test and align the rig before locking it up in a box. The use of the wiring connectors makes this very easy to do.

The alignment is relatively straightforward and you will need only two or three items of test equipment: a general coverage receiver, an HF transceiver, and some means of measuring power output. My rig came into alignment very easily, and went right to the rated output of 3 watts. The sidetone is a sampling of the RF output, so its pitch is a direct representation of the transmit offset and there is no adjustment necessary. The VFO range turned out to be approximately 85 kHz, down a bit from the rated 100 kHz, but within the tolerance of the varicap.

The GM-20 on air

The first thing you discover when you take your GM-20 into the real world is that the receiver is *sensitive*. It is every bit as sensitive as the big rigs and has adequate selectivity. The filter skirts are steep, and although you may prefer a narrower bandwidth, you can usually use the RIT to throw an unwanted signal out of the passband. A variable bandwidth filter would be nice, but there are enough inexpensive external audio filter kits around so that it really isn't necessary.

The keying is clean and precise, and the sidetone is pleasant to listen to. There is no apparent drift, and the QSK function is very smooth.

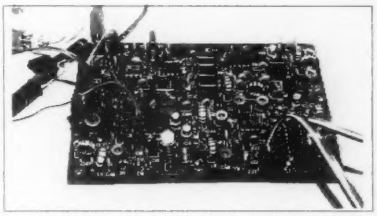
It's always a thrill to make that first QSO with a new rig, especially when the other station is on the other side of the continent, also running QRP, and gives you a good signal report. Say what you like about solar minima, but there is some real truth in the QRPer's motto: "Skill, not power!"

Conclusion

The Green Mountain series represents a terrific value for the money, and the rigs are great fun to use. Watch out—QRP is addictive! It's probably not a good kit for a beginner, but if you have at least intermediate kit building skills you will find that it's easy, and you will have the added benefit of knowing that you really built something!

The Green Mountain transceiver kits comprising circuit board and all board-mounted components are available from: Small Wonder Labs, 80 E. Robbins Ave., Newington CT 06111; (203)-667-3536.

Note from the Big Cheese: *If you build one of these rigs please let me know what fun you've had with it after a few days on the air. I want to know, and if you've made any really interesting contacts, the readers will be interested too. Wayne* 73



Tricks of the Trade

(1) Never buy a kit from someone who doesn't offer to fix it if you are unable to get it going.

(2) Read the manual! They all say that, but it's surprising how often a problem could have been avoided if you had just read through the darn book first. Those corrections at the end of the manual can cause a lot of grief.

(3) If a copy of the circuit board layout is not provided in the manual, *make* one. Just photocopy the board, both sides. The copy of the component side is useful if component labeling is covered up by the components. A copy of the foil (soldering) side will be invaluable if you have to track down solder bridges; often it is impossible to see whether two points should be connected without referring to the artwork or a photocopy.

(4) If the foil (soldering) side of the board is dirty, or if you got your fingerprints on it while you were photocopying it, clean it with alcohol before you start soldering.

(5) Sort the components and check them off against the parts list before you start soldering. If you find a wrong or missing component, you may be able to get it replaced before you need it, or at least minimize the delay.

(6) If you have any doubts about your soldering skills, do some practice work with junk components and then get a local ham to check your work.

(7) Solder under a magnifying glass. A magnifying desk lamp is the best bet, but a "helping hands" device with a magnifier will do.

(8) Check *every* joint under magnification *as you do it.* Be especially careful to watch for solder flowing onto adjacent tracks or pads.

(9) Keep some desoldering braid handy and fix those mistakes immediately. Don't make a mental note to come back and correct later.

(10) Do no more than 5 or 6 components at a time. Where two component leads share a solder pad, do them both at the same time so you don't solder over an empty hole. Often there is a good reason for the order shown in the manual.

(11) There are two exceptions, regardless of what the manual says: (A) Do the IC sockets first. If nothing else is on the board you can just turn it over and solder without worrying about holding the things in place. (B) Do the toroids next. These are often problem spots, and if nothing else is on the board you can easily use your multimeter to check continuity between the pads, insuring a good joint and continuous coil.

(12) In general, do the smaller components (and those that mount flat to the board) first; larger ones last. Otherwise you may have trouble getting to the holes.

(13) Once you have finished mounting board components, clean the excess flux from the foil side of the board using a commercial flux remover or acetone (be sure to do this in a well-ventilated area and heed the precautions on the solvent container). A clean board is *much* easier to troubleshoot. Look over the joints and reheat any that do not look right.

(14) Before applying power for the first time, double-check that all components are in the right places and have the correct polarity. If you are too lazy to check everything, at *least* check all diodes, electrolytic capacitors, and integrated circuit chips.

(15) When you first apply power, look carefully for any signs of smoke! You may be able to detect a hot spot or a component turning brown in time to disconnect the power and find the problem. If you can, you might also hook an ammeter in series with your power supply so if the meter shows more current than expected you can turn the power off!

(16) Bench-wire all external controls and connectors so that you can test and align *before* you get the circuit board screwed down in a box.

(17) If you do have to send it back, ask for a description of what was wrong with it so you can avoid that problem next time.

Number 48 on your Feedback card

The Carolina Bug Katcher Multiband HF Mobile Antenna

Jeff Gold AC4HF
1751 Dry Creek Road
Cookeville TN 38501

Any mobile antenna is a compromise. I wanted one that would allow me to operate on several bands, but without my having to carry around resonators for each band. One that fit the bill was the Carolina Bug Katcher by Lakeview, the makers of the Ham Stick single-band antennas.

The Bug Katcher sells for $89.50, which makes it one of the least expensive multiband mobile antennas. It provides continuous coverage of all amateur, Mars, and marine bands from 7 to 31 MHz. The Hi Q coil gives 1 to 2 S-unit improvement over the Ham Stick's. The antenna is 7.5 feet long and stores in a 50-inch-long space.

"I wanted a mobile antenna that would allow me to operate on several bands, but without the need for resonators for each band; the Carolina Bug Katcher fit the bill."

Setup

To set up the antenna I put little clips on the coil and then used an MFJ Antenna Analyzer to measure the SWR for each band I wanted to set up (see **Table 1**). Once I had the bands set up it was a matter of just switching a quick disconnect clip from one of these set points to another to change bands. Yes, I have to get out of the car, but it only takes a few seconds to switch bands.

Fitting the antenna mount to the car was the most difficult part for me. The main function of the mount is to provide mechanical stability and support, since going down the road at 65 mph places a significant wind load on the antenna. The second function of the mount is to provide a good ground.

In today's automobiles you can't assume that a trunk lid or bumper is grounded, so it's a good idea to use an ohmmeter to check for a low resistance path (less than 25 ohms) between the grounded portion of the mount and the negative pole of your car battery. Or you can use a magnetic mount on the roof, which provides a nice ground plane effect.

Mobile antennas work best when they're high and in the clear. Some hams drill a hole in the car roof to mount the antenna. While this is probably the ideal installation, there are a few hams who are unwilling to drill holes in the roofs of their cars! I'm one of the latter, so I use the Lakeview Quad Magnet mount ($49.95) on my mini-van. I just stick it on the roof, thread the coax through the door, and I'm ready to go. I have to watch it going under low tree limbs and through parking garages. Although I have used this setup with the Bug Katcher, I feel a lot more comfortable using a heavy duty split ball mount. I used the one from Lakeview ($21.95 cat #075) on my other vehicle and haven't had any problems.

Operation

After I finished setting up the Carolina Bug Katcher on my car, I turned on the rig and tuned around on 20 meters. I heard Dale WA7KYT operating a Special Events Station on the West Coast. He was a 57 and gave me a 55. Considering he was on a directional antenna and I was on a mobile antenna, I sure couldn't complain. I next talked to OE6T, who was working an SSB contest.Once again I didn't have any trouble at all making or maintaining contact. I have used the Bug Katcher on both CW and SSB with a great deal of success.

You can get more information from Lakeview Co., Inc., 3620-9A Whitehall Rd., Anderson SC 29624. Telephone (803) 226-6990 or FAX (803) 225-4565. 73

Photo A. *The Carolina Bug Katcher mobile antenna from Lakeview Co.*

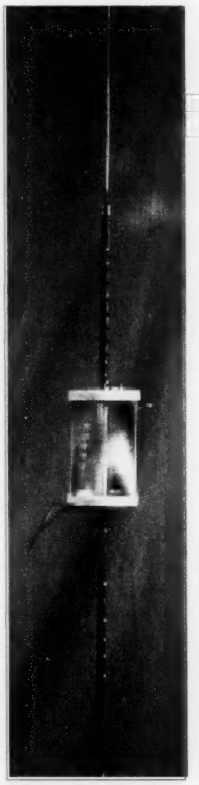


Photo B. *The Bug Katcher at work.*

BAND	BAND WIDTH-2:1 SWR POINTS
40 meters	30 KC
30 meters	all
20 meters	250 KC
17 meters	all
15 meters	400 KC
12 meters	all
11 meters	entire band
10 meters	800 KC

Table 1. *SWR figures for each band setup.*

Economical High Current Power Supply

A "smart" battery charging system to build.

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Independence WV 26374

It was a dark and stormy night...well, it was. A blizzard caused a power failure, and it got very dark and very quiet very fast. The setup I use to keep the battery in my Field Day camper charged came in *very* handy—I was able to put my HF radio back on the air. In fact, it worked so well I now use it as a power supply.

With this circuit and a small 800 mA wall transformer, I've been able to forget maintenance on the battery over the winter. The battery (a regular auto battery, not a deep-cycle) is 4 years old and has not degraded appreciably.

Why it works

Most new transceivers use 12 volt direct current for operation. Getting the high current necessary for transmitter operation requires an expensive power supply. Here is a way to reduce this cost as much as possible.

Modern transceivers require 12 volts at 1 or 2 amps for receive operation. This is not a difficulty. A well filtered, well regulated 3 amp power supply will sell for less than $25 new from a radio supplier and even less, used, from a flea market. The high current problem starts when transmit operation begins. When in the transmit mode, current consumption of a 100-watt rig could exceed 20 amps. This high current demand lasts only a short time but it is real and must be serviced. Knowing how much power must be made available for transceiver operation can be analyzed in a limited manner.

Let's consider a CW QSO. The on/off operation of a CW signal produces a duty cycle of just a little more than 50%. Since transmit/receive is about even—we listen as much as we talk—this theoretical CW QSO is about 25% key-down transmit and 75% key-up receive. This would imply that the long-term (over the total QSO) current consumption of a CW transceiver requiring 20 amps key down will be only 5 amp hours for each hour of transmitting time and 1 or 2 amp hours for receive. The total would be 6.5 amp hours (25% of 20 + 75% of 2).

When this transceiver is operated from an automobile, we supply high current from the auto storage battery and replace the power with the car's charging circuit. It is not necessary to have the charging system supply the high transmit current. It is entirely possible that with lights, air conditioner, fan, and windshield wipers on, the charging system will not be able to meet the demand. It will, however, be able to replace some of the energy used, little by little, as we motor down the highway. If this same type of operation could be used at home, the average current draw would be supplied by the much smaller, more economical power supply, and peak current would be supplied by a battery and a battery charging system.

How it works

A storage battery is used as a reserve for the high current operation requirement and is recharged with a small low cost, low current "smart" battery charging system that can be left on indefinitely without harming the battery.

"It's a small low-cost, low-current 'smart' battery charging system that can be left on indefinitely without harming the battery."

The project is built in five systems. The first system, "the smarts," senses battery voltage. The second, a logic circuit, provides switching signals. The third is an oscillator, used as an AC-to-DC converter. The fourth is the power FET or switch and the driving circuit, and the last is a power conditioning circuit.

The smarts of the charging system come from monitoring the battery voltage to keep the battery at or near full charge. The circuit operation is as follows. Battery voltage is divided by resistors R3, R4, and R7 and fed to comparator U3A and U3B. U3, an LM339, is a quad (four devices on one chip) voltage comparator. The output of comparator U3B is set to go low when battery voltage is above 13.5 to 14.0 volts. This voltage is the "Turn Off" signal of the charging system. When the battery

Photo A. *The completed power supply unit. (Photo by John Jacobs, Independence WV 26374.)*

voltage reaches this point, charging ceases. The output of comparator U3A is set to go low when battery voltage is below 13.0 to 13.5 volts. This is the "Turn On" signal of the charging system. When the battery voltage is below this point, charging commences. When battery voltage is below "On," the system will be on and when the battery voltage is above "Off," the system will be off.

These two signals are connected to U1, a 4011, a quad 2 input NAND gate. U1A and U1B form the logic circuit. These two NAND gates latch the charging circuit on until the "Off" signal is reached and keep it off until the "On" signal is reached. This hysteresis of 1/2 to 1 volt keeps the circuit from turning on and off at microsecond rates. In normal operation, the charging circuit may stay off for as long as 20 seconds. In some cases, depending on battery age, capacity, and condition, it could look as if the battery voltage were being held at the "Turn On" voltage. Actually, the voltage rise of the battery is so fast that it looks like current is continuous. This can be verified with an oscilloscope. This will taper off in time. The switching action prolongs battery life by keeping the battery from gassing. Battery gassing is destructive to the battery and requires more maintenance. The output of the logic circuit (Drive) goes to an oscillator.

U2 is a 4047 IC oscillator with an operating frequency of about 2500 Hz. It is turned on with the signal from the logic circuit (Drive). It is used to make alternating current from direct current The alternating current is rectified and used to drive the gate of the power FET. The AC output of this oscillator is coupled to T1, a simple interstage transformer, through capacitor C2. The output of T1 is rectified and applied to the gate of Q1. This voltage has reference to the source terminal of Q1, and produces a positive 12 volts added to the battery voltage without regard to battery voltages. This high voltage (about 25 volts) feeds the gate of Q1 which connect the battery charging voltage to the battery. Q1 is a power field effect transistors that will have a very low resistance when turned on. The junction resistance of the transistor goes down markedly when the gate voltage is increased. However it must be kept lower than the breakdown voltage of the gate. On the specified transistor this is 20 volts. Even with the low resistance, the transistor may get warm and should be fastened to a heat sink if current of more than 2 or 3 amps is supplied. The power conditioner is a full-wave bridge rectifier, filter capacitor and regulator circuit.

Make it work

The circuit board makes construction very easy. All parts except the power transformer are mounted directly to the board. Construction time should average about one hour. Start with the resistors, capacitors (with the exception of the electrolytic capacitor), diodes (observe polarity), terminal strip, transformer, voltage regulator, the power FET, and all the ICs. Sockets for the ICs are not necessary and cost more than the ICs. The electrolytic capacitor is large and should be installed last.

The resistors in the voltage divider circuits were 1% precision resistors on the first few chargers that I built. I have found however, that the precision is not necessary. The range of the "Turn On/ Turn Off" voltages are not at all critical so the 1% precision resistors are not needed. I have since used 5% resistors and they work just fine. This no-adjustment approach removes lots of unnecessary fussing. The voltage "ON" and "OFF" values may be different from their intended values of 13.0 and 14.0 volts but the difference will be inconsequential to the operation of the power supply. As long as turn off is 14.2 volts or lower, and turn on is above 12.8 volts, appropriate operation will result.

Any power transformer with output of 12 volts AC will power the system. The bridge rectifier diode I specified is rated at only 4 amps and the capacitor has a working voltage of 25 volts. These are the limits placed on the transformer. I have found that a small wall transformer rated at 12 volts AC 800 mA will keep my 100-watt HF station running for more than 3 hours a night and be ready to go again the next night. A 3.5-amp wall charger would recharge the battery completely in about one hour for each hour of actual operation. Depending on the radio, the bigger transformer may cause some hum.

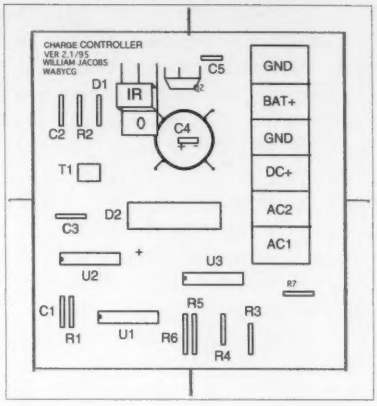

Fig. 2. Silk-screen pattern.

There are no blinky lights on this project. Intentionally. Operation can be checked with a voltmeter and once proper operation is verified, the power supply will be relegated to the floor under the table. No further thought will be given to it.

All that's left to do now is to connect a battery, rig, and the charge controller together and have fun. The use of a covered plastic marine battery box is recommended. If a scrap of wire should happen to come in contact with the

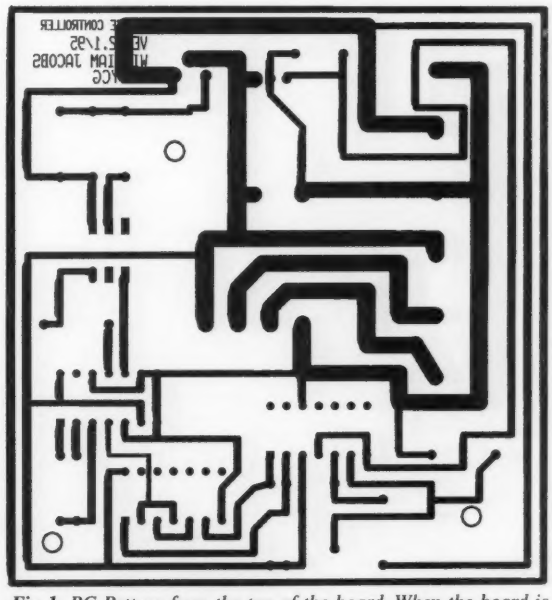

Fig 1. PC Pattern from the top of the board. When the board is printed, the text will be "correct reading."

battery terminals, the energy stored in the fully charged battery will be turned to heat—absolutely spectacular! Avoid it!

In operation the battery voltage will fluctuate between approximately 13.0 and 14.0 volts. This can be easily observed with a digital voltmeter. The voltage fluctuation may be hard to see on a 50-volt scale of an analog meter. It will, however, be easy to see the charge current switch on and off as the circuit maintains the full charge of the battery.

This circuit will also work with a solar panel. There is no blocking diode so the charger uses power all the time. The drain on the battery is about 10 mA. A good blocking diode would eliminate this. Before you add it, considering the following: The average night is 12 hours. 12 hours times 10 mA is 120 mA-hours. Charging at 1 amp the battery drain will be restored in 7.2 minutes. I feel it is better to lose the 10 mA than to limit the maximum charge by the diode-caused voltage drop. If your panel has more loss, you may want to use a diode between the panel and the charge controller.

I have built several of these circuits and have a printed circuit board. Friends have also built the circuit for about $20 plus the wall transformer. If my little project intrigues you and you want a board or all the parts drop me a line. 73

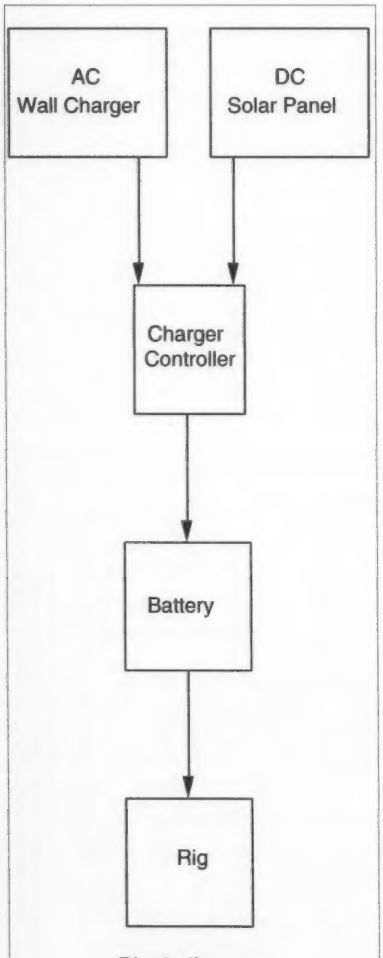

Fig. 3. Block diagram showing solar panel, AC wall transformer, charge controller, battery and rig.

Parts List

Name	Number	Value	Mfg.
4011	U1	4011	
CD4047	U2	4047	
LM339	U3	LM339	
Capacitor	C1	.01 µF disc	
Capacitor	C2	.01 µF disc	
Capacitor	C3	.01 uF disc	
Capacitor	C4	4700/25V	Xicon XRL25V4700
Capacitor	C5	.01 µF disc	
Diode	D1	1N4001	
Full Wave Bridge	D2	TL402	TCI
Terminal Strip	J1	NC6-P107-06	Augat
Resistor	R1	10k 1/4 watt 5% carbon	
Resistor	R2	1 m 1/4 watt 5% carbon	
Resistor	R3	4.7 k 1/4 watt 5% carbon	
Resistor	R4	750 1/4 watt 5% carbon	
Resistor	R5	20K 1/4 watt 5% carbon	
Resistor	R6	20K 1/4 watt 5% carbon	
Resistor	R7	10K 1/4 watt 5% carbon	
N Pwr FET	Q1	IRF531	IRF
Volt Reg	Q2	10V reg	ECL 78L10BP
Transformer	T1	TL009	Mouser

All parts are available from Mouser Electronics, 12 Every Ave., Randolph NJ 07869 (800) 346-6873.

PC boards are available from the author for $6.00. A PC board and all parts with the exception of the wall transformer are available for $22.00. A small project box is available for $5.00. Please add $2.00 to all orders to help with shipping.

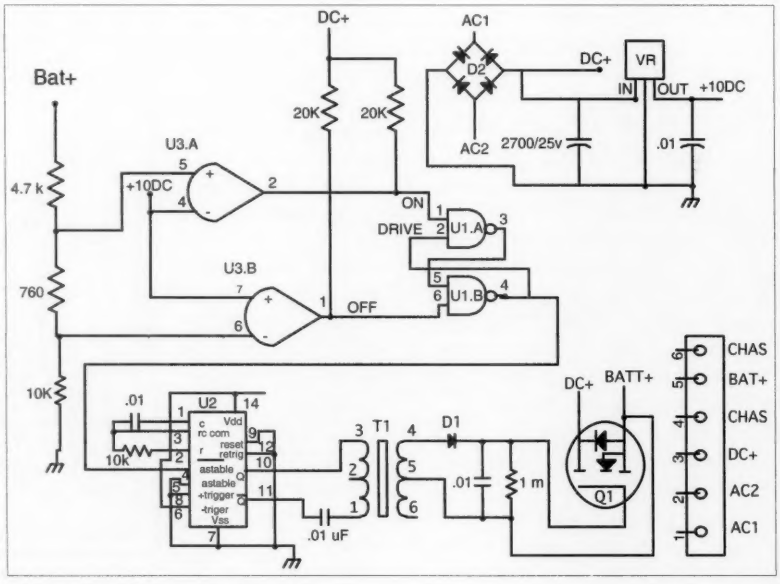

Fig. 4. Charge controller schematic.

HOMING IN

Radio Direction Finding

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Talking T's and Hidden Repeaters

"The T is on the air!" That announcement is sure to give an adrenaline surge to everyone at the starting point of a mobile hidden transmitter hunt. When you start out on a T-hunt, as these radio direction finding (RDF) contests are called, you never know where you'll end up and you don't know what you'll find there. No wonder most hams who try T-hunting get hooked on it.

With high-gain quads, Doppler sets, and other state-of-the-art RDF equipment that I have described in this column over the years, finding a hidden signal ought to be easy, right? Alas, T-hunting is far from an exact science. What's more, the hider is doing everything possible to foil you at every turn. That challenge is what makes it fun!

In a recent exchange of messages on a Usenet ham radio newsgroup, 20 T-hunters told of sneaky spots where hams have put hidden transmitters. A majority involved low-power unattended T's in unlikely places such as the hollow of a tree, the trunk of a police car, a baby carriage at the zoo, and suspended by a wire under a bridge. Christopher Greenhalgh N8WCT wrote, "It's fun sitting in your car, watching the guys run up to you with a big smile thinking they have won, only to say, 'You have to find the actual transmitter,' which you have stuffed in a bush about an eighth mile away, being watched through your side-view mirror."

Canned messages from canned T's

For stunts like these, you need a self-contained T package, ready to deposit at the hidden site and leave for the duration of the hunt. Ten years ago, hams made them with miniature tape recorders. Endless-loop cassettes designed for answering machines would repeat sound effects or short messages continuously, along with station identification.

The possibility that a T will get drenched by rain, heavy dew, or automatic sprinklers makes some sort of sealed enclosure a necessity. Military surplus ammunition cans are a popular choice because they are waterproof and will hold a handie-talkie, recorder, audio/timer board, and sealed lead-acid battery big enough to power the HT for several hours. Sometimes the hunt circumstances demand something even smaller. Two meter transmitter boards by Agrelo Engineering (see last February's "Homing In") are just right for occasions when you need a truly tiny T. That company also sells miniature digital voice recorder (DVR) boards that perform like a cassette recorder, but are stamp-sized and more reliable.

Agrelo Engineering has plenty of experience with digital voice technology. According to owner Joe Agrelo N2OOC, "Our principal business comes from custom designs involving our DVR boards for clients around the world. They are great annunciators for product displays, vending machines, amusement parks, and museums."

N2OOC recommends his Micro 1.4 models (**Photo A**) for most hidden T applications. "This is a multi-message microprocessor-controlled recorder designed around the ISD2500 series voice recorder chip, using Direct Analog Storage Technology (DAST)," he says. "The voice messages are in EEPROM and need no battery backup for 100 years. This is not a computer voice synthesizer, but an actual digital audio recorder, so the sound is very natural. Its 'sleep' mode increases battery life. When standing by between messages, it shuts down power going to parts that are not being used."

A standard Micro 1.4 board will record and play up to 255 separate messages, totaling up to 90 seconds. It has an external trip terminal for each of the first four messages. A momentary ground on a trip pin causes the unit to wake up, play the entire message, then go back to sleep. While the message is playing, the on-board microcontroller holds a push-to-talk (PTT) output high or low (your choice) to key your hidden T. Holding a message pin grounded causes the unit to repeat (loop) that message continuously.

The loop mode is ideal when T-hunt rules require a continuous transmission. On the other hand, the ability to go to sleep makes the Micro 1.4 ideal for Ts that transmit infrequently. For example, the MMRA hunts in eastern Massachusetts are often difficult long-term events with transmissions only every five minutes or so. To take advantage of the sleep mode, you will need a simple external timer circuit to ground a message trip input when a transmission is scheduled. N2OOC says he plans to sell a circuit board for such a timer; it may be available by the time you read this.

The ISD2500 chip contains an on-board amplifier capable of putting 50 milliwatts of audio into a small speaker. You won't need that much audio to drive the mike input of your transmitter, but it might be useful for building decoy "audio bunnies" to spoof the hunters as they "sniff" on foot.

Two tiny push-buttons on the Micro 1.4 control all functions and programming. They double as Record/Play buttons and Menu/Sub-menu buttons. Once you have recorded your hidden T message using the supplied electret microphone, it will take some button-pushing to get into the Auto-Play mode and set the delay time. First command it into the Menu/Sub-menu mode, go to menu 2, 3, or 4 (for 10-60 seconds, 1-6 minutes, or 10-60 minutes delay, respectively), press Sub-menu the correct number of times for the delay you want (counting the number of LED flashes to be sure you did it right), then press both buttons to start the program. If power to the board is interrupted for any reason, your message is not lost but you must repeat the above sequence to get it into Auto-Play mode again.

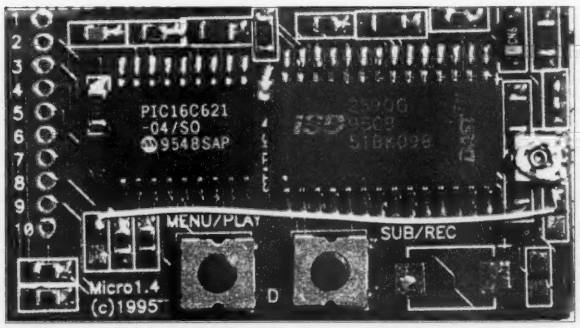


Photo A. *The Micro 1.4 Digital Voice Recorder board measures only 1" x 1-7/8". This is the simplex repeater version, which gets all incoming audio from the repeating transceiver. An electret microphone is supplied with all other versions.*

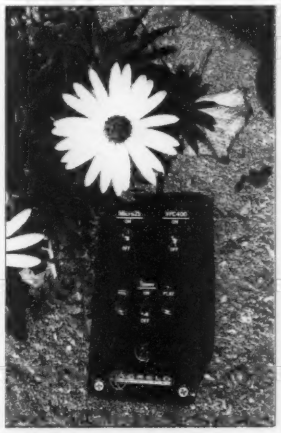


Photo B. *This little hidden T has gotten a workout during practice sessions for on-foot foxhunts at Hamcon-95 and the West Coast VHF/UHF Conference. It contains a digital voice recorder, timer board, and 190-milliwatt transmitter, all sold by Agrelo Engineering. Four AAA alkaline batteries power it.*

If you are concerned that accidental interruption of power during the hunt will upset the programming or if you want to avoid all the button-pushing during setup, you can have N2OOC make a custom "fox" version of the Micro 1.4 for you. When power is applied, it will come up in the Auto-Play mode. The transmission timing for such a custom unit is predetermined and cannot be changed in the field.

To illustrate how easily Agrelo microtransmitters and DVR boards go together to make a tiny T, N2OOC built one in a 4-3/8" x 2-1/2" x 1-1/4" plastic box (**Photo B**). "The label was made on Corel Draw and laser printed," he says, "Then clear packing tape was applied to the top and cut out. This is a great way to make your own labels."

The enclosure could have been much smaller; size was dictated by the need to have big enough batteries to power the T for the duration of a hunt. Switches should be relocated inside the box to prevent accidental movement. Agrelo Engineering sells two smaller Pactec ABS plastic enclosures (2.4 x 1.6 x 0.8 inches and 2.4 x 2.3 x 1.0 inches), but does not sell complete T's like this.

What's that echo?

Although you call your local .34/.94 machine a "repeater," it doesn't actually repeat what you say. It merely listens to you on one frequency and retransmits your audio in real time on another. On the other hand, your packet controller in the digipeater mode really is a repeater. It digitally "records" packet messages and "plays them back" on the same frequency a few seconds later. If a voice repeater did the same thing as a digipeater does, it would be a true simplex voice repeater.

A simplex voice repeater in a good location allows weak portable and mobile stations to hear one another's transmissions, just like a regular duplex repeater. Its only drawback is that users must wait for each transmission to be recorded and played back. On the other hand, a simplex voice repeater doesn't require a duplexer or multiple antennas because it operates on only one frequency and doesn't transmit while receiving. All that is needed is an ordinary transceiver, antenna, DVR, and some additional logic for control and timing. A complete simplex repeater system can fit in a briefcase, ready to deploy following an emergency.

Joe Agrelo says, "One day a good friend, George Chapek N2AIG, asked if we could turn our DVR into a simplex repeater for emergency preparedness. We did it, and now anyone can get one. Currently our first Simplex Repeater is being used by our local RACES group with great success."

The Agrelo Simplex Repeater board is a custom version of the Micro 1.4 DVR, with a different microcontroller. According to N2OOC, "The PIC16C620 has four analog inputs as comparators and voltage references. The DVR microphone input becomes the audio input from your receiver. The speaker output goes into the mike input of your transmitter. There are two PTT output lines, one high active and one low active.

"The intelligent squelch feature is accomplished by the microprocessor's analog input," Joe continues. "The audio threshold is about 1 volt peak-to-peak. When the processor detects incoming audio, it goes into the record mode. When there isn't any audio for more than four seconds, or if the DVR chip reaches overflow, the unit stops recording and goes into the playback mode."

Agrelo Engineering sells the Simplex Repeater board for the same price as other Micro 1.4 versions. Repeater functions are fixed in the unit's memory, so at power-up it performs a self-test, then goes into the Simplex Repeater mode automatically. The station ID message is in non-volatile memory. Because of the circuit differences, the Simplex Repeater version cannot be reprogrammed into the timed Auto-Play modes of the standard version.

What does all this have to do with T-hunting? Well, think how much fun a concealed simplex repeater would be as a hidden T!

"A complete simplex repeater system can fit in a briefcase, ready to deploy following an emergency."

Hunters would have to transmit to it in order for it to transmit to them. It would also mimic any other hidden Ts on the frequency. Of course, hunt rules would have to allow for such a device and all transmissions would have to be shorter than the repeater's maximum storage time.

I tested the Agrelo Simplex Repeater in March when WA6OPS, WB6UZZ, KE6IPY, and I hid for the Fullerton Radio Club's monthly Saturday night hunt. Rules require continuous transmissions so we used it as an optional second T, just for fun. When hunters found the main T on 146.565 MHz, a note instructed them to QSY to another simplex frequency and call us. It was then that they learned their transmissions were being delayed and repeated from an unknown location that they would have to find if they wished to have a bite to eat with the rest of the group. The hidden repeater was in our van in the parking lot of a restaurant, hooked to a beam pointed at the main T site a few miles away. Through it, we easily worked the hunters with our handie-talkies from inside the diner.

The Simplex Repeater performed quite well during my tests. Its intelligent audio squelch circuit actuated reliably, losing only a syllable or so at the beginning of some transmissions. Operating through a simplex repeater takes some practice and patience; you must stand by while your QSO partner completes a transmission and it is repeated after a four-second delay. Frequently, operators who could hear each other directly made quick-keyed exchanges without waiting for their replays. When they finished, the simplex repeater dutifully coughed up all their transmissions. But if the exchange went longer than 85 seconds, the simplex repeater keyed up immediately and began playing at the 85-second mark.

The last five seconds of the simplex repeater's memory are reserved for station identification. Five seconds was enough for me to say, "This is the KØOV hidden simplex repeater. Come and find me! But if you want me to transmit to you, you must first transmit to me on this frequency." The Micro 1.4 automatically plays the ID message after every fourth retransmission. If the frequency becomes inactive, it identifies again ten minutes after the last ID, then remains silent until another incoming signal reactivates the repeater function.

The procedure for recording the Simplex Repeater ID message is a bit tedious, but you only have to do it once. The unit must be fully functional with a transceiver attached. You will need another HT or transceiver to talk to the repeater. Press both the Record and Play buttons and wait 85 seconds for the unit to scroll to the end of memory. The LED will be on for the 85-second period, then flash to indicate it's time to record your ID message. Press and hold down the Record button while keying the HT and saying your ID message into the HT microphone, then release the Record button.

Be cautious and you'll succeed

All Agrelo DVR boards are fully assembled and tested, but using one is not a simple matter of "plug and play." Power must be +5 to +6.5 volts DC, so a regulator from your 12-volt source is a necessity. The PTT outputs will source or sink only 20 milliamperes maximum and will switch voltages no higher than the supply. This makes an external relay mandatory for keying most ham transmitters, including handie-talkies. I used an inexpensive reed relay from Radio Shack™, part number 275-232.

I mounted the Micro 1.4 on a 2-1/2" x 1-3/4" piece of unclad perforated board along with the relay and regulator circuits. Cables from this board went to the hidden transceiver's mike, speaker, and PTT connections.

You will need a good eye and a fine-point soldering iron to attach wiring to the row of 10 tiny terminals. Use utmost care in wiring up your Micro 1.4 because its ICs are susceptible to electrostatic discharge damage and the unit is not tolerant of short circuits. The manual cautions never to short the speaker terminals to each other or to ground, never ground the microphone preamp input, never exceed 6.5 VDC supply, and never press a button until all status LEDs are off. Any of these actions can cause permanent damage.

I found that the setting of the transceiver volume control is quite critical for proper Simplex Repeater operation. Not only does it determine the audio quality of the recorded and played back transmissions, it also affects the intelligent audio squelch circuit. If volume level is too high, retransmitted audio will "chop out", and if too low, it will not trigger on stations with low audio. The little LED on the board will barely flicker on audio peaks when the volume adjustment is correct. A little trial and error experimentation is in order here.

"You won't need 50 milliwatts of audio to drive the mike input of your transmitter, but it might be useful for building decoy 'audio bunnies' to spoof the hunters as they 'sniff' on foot."

You will probably find as I did that the proper audio level setting is quite low. The Micro 1.4 intelligent squelch voltage comparator requires a DC ground reference on the audio input. If your radio's audio output is capacitor-coupled and the DC path is broken when you plug into the external speaker jack, try putting a 10-ohm resistor in parallel with the DVR audio input.

Some transceivers put out low level audio hiss or hum at the speaker jack, even when squelched. This will prevent the audio comparator from working properly. To use such a transceiver with the Simplex Repeater board, you must add a carrier-operated squelch circuit (COS) to the receiver. The Micro 1.4 has an input to accept the COS output.

Micro 1.4 DVRs are available from Agrelo Engineering, 1145 Catalyn Street, Schenectady, NY 12303, (518) 381-1057. Both the standard and Simplex Repeater models cost $69.95 each for ninety seconds total audio storage time. Twenty- and sixty-second versions are available at slightly lower cost. Custom programming is available for additional charges. For quantity pricing, warranty information, and shipping rates, see Agrelo's Web page (URL is http://home.navisoft.com/agrelo/ae.htm) or call the company. Send E-mail inquiries to JAgrelo@aol.com.

I want to hear about T-hunts you have experienced where DVRs and/or simplex repeaters were used in clever ways. I prefer E-mail for correspondence (send to Homingin@aol.com or 75236.2165@compuserve.com). I also welcome your cards and letters sent to the address at the beginning of this article. 73

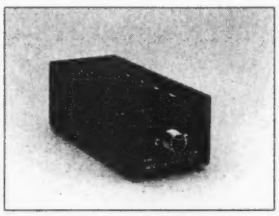
Number 55 on your Feedback card

NEW PRODUCTS

Waterproof PL-259 Available Now

RF Connectors announces the RFU-503, a UHF male solder clamp connector. This PL-259 waterproof plug features silicone rubber front and rear gaskets. The center contact is silver-plated for optimum solderability, the insulation is Teflon™, and the body is nickel-plated.

The RFU-503 is available from RF Connectors Distributors throughout the US, Canada and Mexico. For additional information, call 1-800-233-1728 or E-mail: 102061.2261@compuserve.com.



Ameco Keeps Its Cool

Ameco announces two new, high-performance broadband RF loads: Model DL 1500 is an air-cooled unit that will handle an average of 1500 watts for up to 15 seconds and 150 watts continuously from DC to 650 MHz.

Model DL 1500-F is a forced-air cooled dummy load. It will handle an average of 1500 watts for a full 30 seconds and 300 watts continuously. The DL 1500-F has a low-noise fan that helps keep the non-inductive load element cool for longer life. The SWR for both models is 1.1:1 for 160 to 2 meters, 1.5:1 to 70 cm.

Both units come in a strong, lightweight aluminum case perforated to enhance cooling. For more information, call, write or FAX Ameco Corporation, 224 East Second Street, Mineola, NY 11501. Phone (516) 741-5030; FAX (516) 741-5031.

Continued on page 64

Radio Bookshop

Phone 800-274-7373 or 603-924-0058, FAX 603-924-8613, or see order form on page 88 for ordering information.

Wayne's Book!

WG1 **We The People Declare War On Our Lousy Government** by Wayne Green W2NSD/1 360p soft cover. Wayne's report explaining what the major problems are facing the country, and proposing simple, inexpensive solutions: a simple way to havegovernment departments happily cut their expenses by 50% within three years; how to end welfare; how to reduce the deficit; how to cut medical costs and improve health care. $13

Simple Inductance Meter

Measure small inductances with this easy-to-construct instrument.

J. Frank Brumbaugh KB4ZGC
P.O. Box 30 - c/o Defendini
Salinas PR 00751-0030

The ability to measure small inductances in the range below about 15 microhenries (µH) is of the utmost importance when winding toroids for VFOs, coupling transformers in receivers and transmitters. Many junk boxes contain small coils, IF transformers, and other oddments salvaged from old radios and television sets which, if one knew what their values were, might well be put to use in home-brew equipment. There are commercially available LCR meters which look like DMMs, but which cost well over $100, far more than the usual ham budget can cover. Some DMMs costing a bit less than that have an inductance measuring capability, but only in millihenries (mH) and henries, which is of little use to most hams.

What we need is a simple, inexpensive instrument which anyone can easily construct, and which will measure these important small inductances (coils) with reasonable accuracy. The simple instrument described here will enable you to measure coils in the range from below 2 µH to above 15 µH. This range includes all the values of inductance used in VFOs and most, if not all, RF coupling transformers wound on toroids.

Although this circuit is *theoretically* capable of measuring inductance below 1 µH, in the real world the unavoidable stray capacitance and inductance will usually make measurements this low impossible with such a simple circuit.

It is possible, by using a different frequency crystal than that specified, to shift the range over which measurements can be made. A lower frequency crystal, down as far as 1 MHz, will enable measurement of inductances as large as 1 mH, but the smallest value measurable will rarely be smaller than about 75 µH. Crystals between 1 and 10 MHz will allow measurement ranges between that just given and the design range of this instrument using the specified 10 MHz crystal. Use of a higher frequency crystal, up to 13 MHz, will not allow much smaller values to be measured because of the effects of stray capacity and inductance. Crystals above about 13 MHz will not oscillate in this circuit.

The circuit

Fig. 1 shows the schematic diagram of the Simple Inductance Meter. U1, a 74LS00 two-input Quad NAND Gate logic integrated circuit (chip), two resistors, a capacitor and a surplus microprocessor crystal form a stable crystal oscillator near the marked frequency of the crystal. The RF voltage is taken from pin 8 through isolation capacitor C3, to the measuring circuit. RF voltage is applied through capacitor C7 to J1, a binding post. This same RF voltage is applied to a resistive voltage divider consisting of R3 and R4. A germanium diode D1 has its anode connected to the junction between R3 and R4. RF across the variable tuning capacitor C6 is applied back through C5 to the cathode of D1 and load resistor R5, the lower end of which is bypassed to ground through C4 and applied to the positive terminal of meter M1. R6 is a *sensitivity* control connected between the negative terminal of meter M1 to ground.

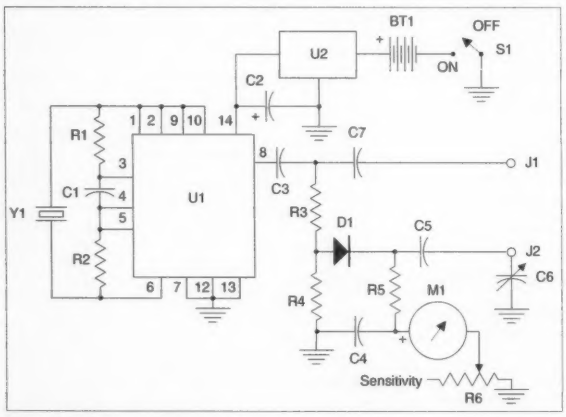


Fig. 1. Schematic diagram.

Construction

This instrument should be constructed on a small piece of perf board or on one of the general purpose printed circuit boards available at Radio Shack™. It should be mounted in an aluminum box, or in an enclosure made from pieces of printed circuit board material, because of the high frequency at which it operates.

Capacitor C6, and binding posts J1 and J2, should be a few inches apart so that when your fingers are adjusting C6 you don't interfere with the field around the inductance being measured.

Leads between J1 and C7, and between J2 and C5 and C6, should be as short as possible, considering the physical distance between J2 and C6. This latter lead should

be bare solid wire, fairly large (up to AWG-12), and should be spaced away from the enclosure wall. Using a fairly large diameter solid wire, and spacing away from enclosure walls, will reduce the amount of stray capacity and inductance in this critical portion of the circuit. You can use as small a wire as AWG-22, but the larger the wire you use, up to AWG-12, the lower the stray inductance.

"This inductance meter should be mounted in an aluminum box, or in an enclosure made from pieces of printed circuit board material, because of the high frequency at which it operates."

Meter M1 can be either a standard 0–1 mA meter, or one of the small plastic meters originally made for CB radio or home entertainment equipment. These latter meters usually have 200–300 µA movements, and the value of R6 may have to be increased by adding a resistor in series with it if the more sensitive meters are used.

However, if you have an analog VOM with a current range of 1 mA or less, and a DC voltage range of 2 or 3 volts, you could install a pair of binding posts instead of M1 and use your VOM to read the peak voltage at resonance, saving the cost of a dedicated meter. Depending upon the Q of the unknown inductance being measured, you may need either a low current or low voltage range on the VOM.

You will have to make and calibrate a dial for C6. Most hams save the circular metal or plastic cutouts made when installing meters and small speakers. These make ideal dials when white card stock is glued to one side, trimmed, then centered and cemented or epoxied to the bottom of a knob, with the knob on the white side of the dial.

If you do not have such a circular cutout—you will probably have one if you mount a standard meter for M1—you can scribe a circle on a sheet of heavy, stiff plastic or cardboard, cut it out carefully with scissors or a hobby knife, then cut a hole in the exact center to pass the shaft of C6. If your dial does not have a clean white surface, glue a piece of white paper or index card stock on it. Trim it when the adhesive has dried, and cement or epoxy it to the bottom of the knob for C6.

Mount the completed dial assembly on the shaft of C6 and tighten the set screws in the knob. Scribe or otherwise mark an index line on the panel extending a short distance outward from the edge of the dial.

Calibration

You will need a few small inductances of known values to use in calibrating the dial. Tiny inductances sold as RF chokes are suitable. Most are available with a ±10% tolerance, which will be adequate, though if you use 5% tolerance chokes, such as those available from Mouser Electronics, your measurements will be more accurate.

If you purchase the following small RF chokes, using them singly and in series in various combinations will allow calibration points at approximately every microhenry from 2 or below to above 15: Buy two 1 µH; two 2.2 µH; one 4.7 µH; and one 10 µH RF chokes to use as calibration standards. Remember, if you connect inductances in series, add the individual values; if you connect them in parallel you can use the formulas for parallel resistors to determine the resulting value. Those values suggested result in only series connections, adding each value to reach the total value, *except* for calibrating at 0.5 µH, where both 1 µH RF chokes are connected in *parallel*. It is extremely unlikely that you will be able to calibrate as low as 1 µH, but you might be lucky!

Switch S1 to ON. Connect a calibration inductor between J1 and J2, adjust C6 for a *peak* indication on M1, and mark this point on the dial. Number it with the value of the calibration inductance. Continue calibrating the dial with various combinations of inductances in the same manner.

You will not be able to number each calibration point, especially if you calibrate at approximately every microhenry. The dial will be very crowded at the high inductance end, but much less so at the low end.

Operation

Switch S1 to ON. There should be some indication on M1, which shows that the instrument is functioning. Connect an unknown inductance between J1 and J2, adjust C6 for a *peak* indication on M1, using the *sensitivity* control as needed, and read the value of the unknown inductance from the dial of C6 opposite the index mark on the panel. If you are using an external analog VOM instead of M1, you may have to switch between DC current and DC voltage ranges to keep the needle on the meter scale, or you may use the *sensitivity* control.

The higher the Q (quality factor) of the unknown inductance, the higher the peak indication on M1 and the VOM. Conversely, a low Q inductance will register a lower peak indication. This simple circuit will not measure Q directly but will allow relative indications. Inductors used in frequency-determining portions of VFOs should have the highest Q possible. This means using the largest diameter wire commensurate with the space available on 70% of the toroid core used. If an air core coil is used, its diameter *and* length should be as close to the same dimension as possible, and be wound with the largest diameter wire practical. This will result in the highest Q coil possible. 73

Parts List

BT1	9V alkaline battery
C1,C3,C4	0.01 µF ceramic disc capacitor
C2	10 µF 16V electrolytic capacitor
C5	0.001 µF ceramic disc capacitor
C6	365 pF variable capacitor
C7	560 pF NPO, COG, Mylar™ or poly capacitor
D1	Germanium diode: 1N34, 1N60, 1N90, 1N270, etc.
J1,J2	Binding post
M1	0-1 mA DC meter (see text)
R1,R2	560 ohm 5% 1/4W resistor
R3,R4	100 ohm 5% 1/4W resistor
R5	1k ohm 5% 1/4W resistor
R6	10k ohm linear potentiometer
S1	SPST toggle or slide switch
U1	74LS00 two-input quad NAND gate

73 wants your feedback...

we've been improving *73* for the past months with more articles, easier reading type, etc. And honestly, we *need* your feedback (in detail) if you have any critique either for or against the subtle changes that we've made. We know we can't please everyone everytime, but if you teil us what you want *73* to be, we'll at least try to head in the direction for further "improvements" that might be most appealing to you. Thanks.

HAM TO HAM

Your Input Welcome Here

Dave Miller NZ9E
7462 Lawler Avenue
Niles IL 60714-3108

In last month's column, Robert Blacka N2WSO offered a good tip on a line of "camouflage" rope offered by The Lehigh Group of Allentown, PA. Since then, I've received their well-laid-out catalog of cordage and accessories, and the rope that Bob mentioned seems to be Lehigh's item # CF450 (the number mentioned in the column last month may be the dealer's stock number along with a UPC code). The catalog describes it as twisted polypropylene rope and says that it holds knots well; resists oil, gasoline and most chemicals; is resistant to rot and mildew; and floats (a trait hopefully not needed in ham radio applications). The standard length is 1/4" by 50'. It comes with an instruction booklet that outlines its proper use and care and describes knotting and splicing methods. Lehigh's phone number is 1-610-398-1830. Their catalog is worth having for general information on cordage and fittings.

Pinpoint it with a laser

We've all heard the expression "a solution looking for a problem." That's what I had considered those new "pocket laser pointers" to be until I thought about it some more. The pen-sized pocket laser pointers are advertised as being useful for large group presentations, and they no doubt are, but how many of us give large group presentations often enough to justify the purchase of one? No question, they'd be fun to play with (just don't look at it or its mirrored-reflection directly), but I needed a bit more incentive than that to spend the money for one. Well, for those of you in the same predicament, here's the justification you've been looking for, and it's a useful one.

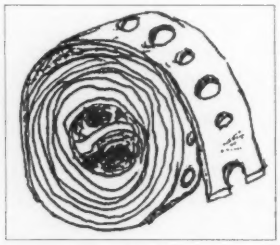


Fig. 1. Steel plumbing strap, as it comes from the blister packaging.

It's usually easy to locate the correct component for replacement on the component side of a printed circuit board since the part numbers are generally silk-screened on that side, but locating the proper pads to unsolder on the foil side of the board is another matter altogether. That's where the little hand-held laser pointer comes in.

Simply hold the pointer over the correct component, on the component side of the board, and then, looking at the foil side—perhaps with the room lights dimmed a bit—you'll be able to see the exact point to unsolder. It's particularly useful with phenolic PC boards, but it even works on the heavier Fiberglas™ boards (though the light does scatter a bit more, depending on the density and "grain" of the board material).

If you'd like to drill a hole through a plastic case, but you'd also like to see where it will end up on the other side of the case before you drill, the laser light will even penetrate some of the less-dense plastics. Too bad it doesn't penetrate aluminum...or drill the hole for you...at least not yet!

Finally, our two younger cats love to chase the "red dot." Be careful not to shine the pointer directly into your own or your cat's eyes; again, intense laser light can be dangerous if misused. Lasers derive their pinpoint energy by forcing all of the photons to march in step, at exactly the same color frequency and in exactly the same direction, much like a well-drilled military marching unit. By the way, our older cat shows some (though dignified) interest, but apparently he considers the laser pen just another variation on the old "dancing-flashlight-beam game!"

These are my contributions. What problems have you solved using this latest "solution looking for a problem" device? Send me your ideas, at the address in the masthead, and I'll compile them for a future column on "sharp-laser-pointer tips."

A strapping good idea

From James E. Brown AE4EY: This suggestion is certainly worthy of consideration. He writes: "My shack is located in the basement of my home, and the closest nearby ground is the cold water pipe running through the rafters about five feet above my operating position. In the past, I simply used wires from each piece of equipment, joined together at one connection point, then a single wire running up the wall and to the cold water pipe. The final attachment was done with a worm-geared hose clamp. There were times when I was plagued by RF feedback due to the many wires acting as resonant antennas at various operating frequencies; I also had concerns about the necessary low-resistance of a single wire grounding system.

"I spotted some steel plumbing strap in the hardware store one day, and pictured that as a much better solution to my RF grounding woes, which indeed worked out that way. The steel plumbing strap is inexpensive enough, between $1 to $2 for a 10-foot blister-packed roll. A couple of rolls of the strapping, plus a dozen 6-32 machine screws, nuts, and washers are all that you need to get going. The particular strapping I'm using is 3/4 of an inch wide and 10 feet long, containing alternating 1/4-inch and 9/64-inch holes throughout its entire length. It's made for jobs like hanging plumbing pipes from wooden rafters, and is easily cut with tin shears or a hacksaw to provide you with the exact length needed.

"Fig. 1 shows the strapping as it comes from its blister-pack. It's easily bent around a circular fastening point or shaped any other way that might be needed to achieve the desired end. **Fig. 2** shows the connection point to the cold water pipe in my own installation and **Fig. 3** illustrates how a solid splice is made to extend the strapping length. **Fig. 4** shows how I've chosen to tap onto the main strap at each piece of equipment, and **Fig. 5** depicts how that piece of gear can be securely fastened to the tap-off using the existing grounding stud present on most amateur gear.

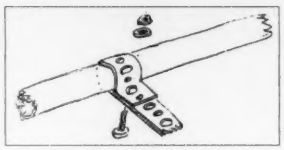


Fig. 2. The connection to an overhead cold water pipe run.

"Since installing the strap grounding system, I've experienced no further in-shack RF feedback problems. What's more, the jumble of grounding wires has disappeared and I've no further doubts about the adequacy of my shack ground system. Be sure that you ground every piece of gear, including any coaxial switches, antenna tuner and the chassis of your shack computer. The more thorough you are in this area, the fewer problems you'll experience with stray RF and/or digital noise ending up where it shouldn't be."

Jim's idea is a good one to keep in mind for your next shack rebuilding project. Since it's relatively inexpensive steel strapping, there will be some inherent RF resistance present in it, but its sheer bulk helps to minimize that factor. If you can find copper hanger strapping, so much the better, but be careful not to mix dissimilar metals if you can possibly avoid it (because of the possibility of electrolytic action taking place at the junction). Also, be sure to carefully sandpaper or wire brush all connecting points for the lowest resistance connections. Both steel and copper quickly oxidize to form high resistance surfaces. If you're using a cold water pipe as the final ground reference, make sure that

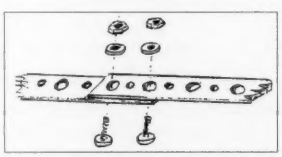


Fig. 3. Splicing two sections of strapping to extend the length.

connection is also well cleaned, and that there are no non-conductive pipes in the line all the way to where it enters the earth ground. Any water meters or other in-line devices should be bypassed with a heavy wire shunt since their carry-through conductivity may be questionable. In a basement installation, quite often a hole drilled through the concrete floor, with a 6- or 8-foot ground rod passing through it, will end up being the shortest and best path to earth ground. Be careful not to inadvertently hit any under-floor pipes or tiles!

A line of affordable project boxes

If you're anything like me, you can never have enough sources for small project boxes, perhaps for a microphone adapter, a couple of outboard switches, or maybe a small-circuit idea consisting of just three or four parts.

One such source of small boxes that I recently came across is Sescom, Inc. of Henderson, Nevada. Their mainstream business is in serving the independent television production community with cables, adapters, amplifier modules, etc., but their newest catalog also boasts a number of what they call "Mini Project Boxes" that are perfect for many ham radio construction needs. Their MPB-1 at $1.95, for instance, is only 1" x 2" x 1", and has proven to be very useful in my own ham shack for small projects. Their current full line consists of a total of 24 various-sized project boxes, from the MPB-1 mentioned to the MPB-2, measuring 1" x 4' x 1", an the MPB-3 at 1" x 6" x 1", on up to the MPB-24 at 4" x 14" x 3" at $6.10.

The boxes are an exclusive design and consist of four flat aluminum sides, two flat aluminum end pieces, four channeled-aluminum 90° "micro extruded" corner angles, and eight self-tapping steel end screws. The flat aluminum sections are .04 inch thick and are unpainted; they're easily drilled or punched medium-hardness aluminum stock, with plastic protective film on both sides for scratch protection during shipping and handling. They arrive unassembled, an interesting concept in mini-box shipping and storage that makes drilling or punching much easier since you're always working on a flat piece of stock.

Assembly takes only a few minutes, and consists of slipping the flat aluminum side plates into the channeled corner angles, then attaching the two flat end plates with the eight small self-tapping screws. The box can be primed and painted if desired—either assembled or unassembled—to match whatever piece of existing equipment the user might want to complement; or it can simply be left natural and perhaps given a brushed finish with a piece of soft steel wool.

Another interesting side benefit of the assemble-the-box-yourself design is the nearly unlimited customization of the final size. If you need a box that fits exactly into a given space, one of the Sescom "Mini-Project Boxes" may be just the answer. Simply choose the box closest in size—but slightly larger—than what you would ideally want, then cut the stock down to the exact size needed with a bandsaw, and you'll have the perfect box to fit your available space. This is something that's virtually impossible to do with pre-formed or molded project boxes.

Sescom's phone number is 1-800-634-3457, or write to 2100 Ward Drive, Henderson, NV 89015-4249, and request their latest catalog. Also unique is their free UPS ground shipping on all orders over $20—plus a 10% discount on quantities of 10 or more of the same size box. Not a bad deal.

By the way, any commercial products that I mention in this column are completely unsolicited; they're either items that I've actually tried, or ones that have been recommended by *73* readers. I've not been approached by any manufacturer and wouldn't respond if I were. The intent of this column is to inform *73* readers of ideas, tips, suggestions, and, yes, sometimes unsolicited products if they apply. It's not a paid ad sheet. I just want to make sure this is clear.

A handy paddle reversing switch

From Gary Bartlett VE1RGB: An idea that fits well into the Sescom MPB-1 project box talked about above. "As an ardent CW Op, I frequently carry my own paddles with me when operating someone else's station—such as on Field Day. Not every rig, however, is polarized the same way with regard to which input connection is 'dit' and which is 'dah.' Trying to rewire the paddles each time, in the dark or the cold, isn't really the answer. The real answer is a small, sturdy project box, containing an easily operated DPDT paddle polarity reversing switch...one that will work from one set of paddles to another, as well as from one transceiver to another. Fitted into a small aluminum box, the reversing switch (**Fig. 6**) will also allow you to change 'keying hands' quickly, such as when the need to log with your right hand forces you to send with your left. Few Ops can master that feat, but the reversing switch makes it possible."

"Quick testing" capacitors with an ohmmeter

From Peter Albright AA2AD: Some good information for us on the theory and practice of testing capacitors with the absolute minimum of test equipment. "Did you know that your analog (needle-style) multimeter can be used in the 'ohms' position to test capacitors? Although the theory is straightforward, practice is a bit tricky because of differences between real-life multimeters. Follow along and you'll see why."

THE THEORY: In a DC circuit, capacitors act like a reservoir, holding electrons rather than water. When a DC voltage is applied to a capacitor, it fills (charges) as electrons pile up on the plates. While it's charging, there is measurable current flow in the leads. Current flow, or amperage, is greatest when the capacitor just begins to charge; at the instant that voltage is first applied the capacitor looks pretty much like a short circuit, with a resistance value of near zero ohms. Current flow approaches zero as the capacitor approaches a fully charged state. When fully charged, the capacitor looks like an open circuit, with nearly infinitely high resistance. A perfect capacitor would hold this charge

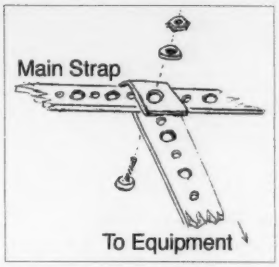


Fig. 4. Tapping into the main grounding strap for connection to an individual piece of equipment.

forever, or until the electrons are drained off by some external circuit connecting the capacitor's two plates. Even a real-life capacitor can hold its charge for quite some time.

An ohmmeter works by applying voltage across the device to be measured. Although the meter is calibrated in ohms, it is actually measuring current flow. Remember Ohm's Law:

$I = E/R$

For a given voltage, the lower the resistance, the higher the current. An interesting, counter-intuitive corollary is that analog ohmmeters put a resistor network between the meter and the device to be tested. When you switch the meter to a higher resistance measurement range, the resistance value of that network is increased.

There's one final piece to the puzzle. When a capacitor is charged through a resistor, an elementary timing circuit is created. Increasing either the value of the resistance in ohms (limiting current flow) or the value of the capacitor in farads (the size of the

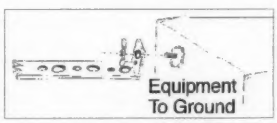


Fig. 5. Connection to the actual piece of ham gear at its rear ground stud. If a direct connection via the steel strapping isn't practical (because of the need to pull a particular piece of equipment out to gain access to the rear apron), then a short piece of flexible braid with a terminal lug installed on it (such as the braid from the inside of an RG-8 coax cable) can be used as a jumper to the main strap.

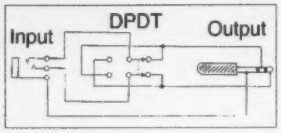


Fig. 6. VE1RGB's CW paddle reversing switch used to flip-flop the "dit" and "dah" connections on oppositely wired amateur transceivers, or for changing "fists" under contest conditions.

"reservoir") will increase the amount of time that it takes for the capacitor to charge fully, and for that charging current, measured in amps, to drop to zero.

THE PRACTICE: As always, begin with a careful visual inspection. Defective capacitors are often physically deformed by bulging, leaking, or showing heat damage. They may be "microphonic," showing functional instability when tapped gently with a plastic stick while the circuit is active. A microphonic capacitor is bad, and no further testing is indicated. After you have decided that there might be a defective capacitor in the circuit, follow these steps:

1. Turn the rig off and unplug it, or remove the battery if that's the source of power.

2. This step is important—it protects you, your equipment, your tools and even the component to be tested. Make sure that the capacitor is fully discharged by placing a direct short between its two leads or terminals with a clip lead. Remember to be careful: If the capacitor is a large value power supply electrolytic cap, it can deliver enough current to put a nice nick in your screwdriver blade, even at 12 volts! It's always a good idea to discharge large capacitors (or capacitors in high-voltage circuits) through a 100 ohm, 2 watt resistor for a full minute or more before putting a dead short across its leads.

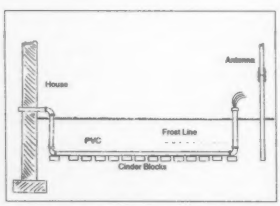


Fig. 7. Side view of the overall PVC pipe/cable raceway scheme described in the text.

3. The capacitor to be tested must normally be removed from the circuit. It's sufficient to disconnect only one lead, leaving the other lead soldered in place since it's only a two-terminal device. After you disconnect the capacitor, discharge it again to be sure its "reservoir" is completely "empty." Even with a dead short across it, a capacitor may take several seconds to discharge completely, because of its inherent internal resistance. Good technicians always practice accepted safety techniques!

4. Now set your analog multimeter to measure resistance. The range setting that you'll choose will depend somewhat on both the value of the capacitor to be tested and the characteristics of your particular meter. On my favorite meter, I generally use the R times 1 range for electrolytic capacitors larger than 50 µF, and the higher scales for those smaller capacitors—up to the maximum of the meter's range for very small ones of .001 µF or less. Remember the theory above? By changing the meter's range setting, you're putting different resistances in series with the capacitor, thus making the time constant of this series charging circuit long enough so you'll be able to see the meter move as the capacitor takes on a charge.

5. Next, connect one ohmmeter lead to one of the capacitor's leads. For electrolytic capacitors, be sure to observe polarity of the capacitor as marked on the case. You can't assume that the negative lead of your ohmmeter applies negative voltage to the outside world, so check your ohmmeter's polarity with a second voltmeter.

6. Watch your meter's needle and touch the free meter probe to the other capacitor lead. The needle should quickly swing toward zero ohms, then reverse direction, and then more slowly work its way back toward infinity. The speed at which this happens depends on the value of the capacitor and the characteristics and range setting of the multimeter. If all of this happens too fast to see, return to Step 3 (discharge the capacitor) and try a higher range setting on your multimeter. If, on the other hand, the meter's needle moves excruciatingly slowly, you can simply switch the meter to a lower range setting without harming anything.

7. If the meter never swings toward zero ohms, the capacitor is open, and defective. If the meter never returns to infinite resistance, the capacitor is "leaky."

8. When the meter reaches infinite resistance, remove one lead. Wait about 20 seconds, then reconnect the lead. The meter may twitch a bit, but if it noticeably swings back toward a low resistance reading, the capacitor is leaky. A good capacitor holds a reasonable charge for longer than 20 seconds.

"You can practice this technique on a variety of capacitor values to get a feel for what should happen with the different sizes, and to determine which range on your own multimeter gives you the most satisfactory reading times. You should get no false negatives: If the capacitor is leaky or open, it's bad. A good reading is not absolutely conclusive, however, because the capacitor may break down under the higher voltage of the actual circuit it's being used in, or it may have changed in value. This 'quick test' tells you nothing about the capacitor's voltage breakdown point, nor does it give more than a rough idea of the actual value—other than by the time it takes to charge through a certain series resistance.

"Also, keep in mind that when replacing a capacitor in any tuned circuit, it is important to use an exact replacement, both in terms of value and type (the material that the capacitor is made of can be critical). The higher the frequency at which the circuit operates, the more critical that replacement exactness becomes. The replacement capacitor's lead lengths should also match the original and its physical placement should replicate the original as closely as possible.

"In the case of power supplies you have some more leeway. Except for the voltage rating, which should be the same or slightly higher, the capacitor's value can generally be up to 150% higher than the original.

"Finally, never use a capacitor with a lower voltage rating than the original, and always strictly observe the polarity markings on electrolytics and tantalums. If you ignore this caution, you'll eventually have a capacitor explode inside your rig like a small firecracker, leaving you with an unpleasant cleanup job."

Hot tips!

From Michael Fratus: A tip on how to spot broken solder connections in ham radio equipment. "Solder breaks make up a higher percentage of direct and indirect causes of failure in electronic equipment than many people think. When working on any ailing printed circuit board, if you notice a semicircular ring around a solder joint—or any sign whatsoever of crystallization or fatigue—touch up the connection with an appropriately hot soldering iron and a bit of fresh 60-40 solder. Pay special attention to the connections on heavier components, any PC board connectors, and all board-mounted controls for signs of 'flex' stressing. This can be a problem, particularly in a mobile environment where lots of vibration is present, and in areas of extreme temperatures.

"Any 'stress fractured' solder joint can become thermally unstable, resulting in an intermittent connection with hot and cold, and is often responsible for what might seem bizarre symptoms. Unless you solve the real problem, you'll be working on that piece again! Taking the time to quality-check the unit while you have the board exposed will give you more time for operating and less for servicing in the future!"

Did someone say "Underground"?

From Bill Thim N1QVQ: An idea for running "coax underground back to your shack using PVC piping as a raceway. It helps protect the coax and also makes running any other cables in the future an easy job. You can buy PVC pipe with holes already drilled into one plane of it, in 4"

and greater diameters. Four inches may sound like a lot, but it can fill up fast if your station antenna farm begins to grow...whose doesn't? The bigger you can manage, the better. Of course, you can also drill holes along a length of smaller PVC pipe if your future plans are more modest. The proper way to lay the pipe underground is shown in **Fig. 7** and **Fig. 8**. Dig a moderately sized trench, preferably below the frost line. When the pipe is laid, the holes should be straight down, the pipe should rest on blocks or loose gravel for drainage (cinder blocks with the hollow channels pointing up and down are an excellent choice). The entire length of pipe should then be 'draped' with plastic sheeting over the top, to act as a water-diverting shield when the soil is placed back over the top of the trench. Sounds like a good bit of work—and I suppose it is—but doing it correctly will save you countless problems in the future.

"A way to handle the out-of-doors end of the run is to construct a 'weather elbow' out of PVC fittings as shown in **Fig. 9.** This type of scheme will not allow water to enter the pipe's end, yet will provide easy access for new cable runs in the future, though more 90° turns are involved. A wad of Fiberglas™ insulation pushed into the end of the pipe will discourage insects and other unwelcome visitors!

"Ideally, the shack end of the pipe should go through the wall of the building itself, for maximum convenience and weather-resistance. You might even put a small 'hamfest-gem' 3- or 4-inch whisper fan at the building end, pulling air from the pipe into your shack, for free cooling in the summer and warming in the winter! The fan will also help to replace the air inside the pipe and keep it dry.

"Finally, an electrician's 'fish tape' should be used for the initial cable pull...don't forget to put in some sort of 'come-along' rope that can be used for future pulls. It can be a loose rope running along side of the cables, or a 'trolley' arrangement, configured with a loop of rope, separately hung, running the entire length of the piping. Sometimes, a loose come-along rope, though simple to install, will wind around the cabling, making it more frustrating to pull in future runs. Consider using the trolley idea if you can; **Fig. 10** shows one way that this can be accomplished on a fairly straight run. Its practicality depends, to some degree, on the length of the run and on the size (diameter) of the pipe. Choose whichever method you feel is most practical for your own installation."

It's obvious that Bill has thought out the problem well, and his suggestions might apply to all of us, no matter what antenna system we might have in mind. As Bill pointed out, it's vitally important to keep an underground conduit raceway dry. Coax cable was never meant to "tread water." Make sure that the cable you choose for an underground setting is free of any (even slight) defects in the outer jacketing. Any moisture whatsoever inside the shielding of the cable will literally destroy the RF shielding quality and conductivity of the cable's shield conductor. The braided shield must make good electrical contact with its neighboring wires to represent a continuous "pipe." We can get away with the flexibility of a braided shield in our cables—as opposed to a solid outer piping—only because each strand of the shield overlays every other strand, simulating a continuously-walled pipe; but that simulation must be maintained throughout the length of the run. Be sure to tune in next month for more worthwhile tips, ideas and suggestions.

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Please send all correspondence relating to this column to *73's* Ham To Ham column, c/o Dave Miller NZ9E, 7462 Lawler Avenue, Niles IL 60714-3108, USA. All contributions used in this column will be reimbursed by a contributor's fee of $10, which includes its exclusive use by *73*. We will attempt to respond to all legitimate contributors' ideas in a timely manner, but be sure to send all specific questions on any particular tip to the originator of the idea, not to this column's moderator nor to *73*.

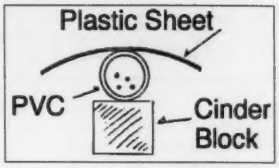

***Fig. 8.** Cross-section view of the underground PVC pipe/cable raceway described in the text.*

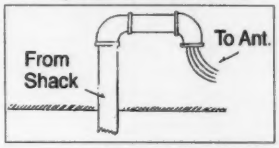

***Fig. 9.** Scheme for exiting cables at the outdoor end of the run. Though more bends are involved, the possibility of water entering the piping is greatly reduced.*

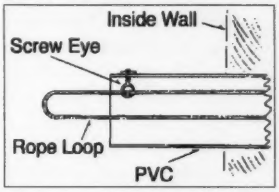

***Fig. 10.** Side view of PVC pipe/cable raceway as it enters the building interior, showing the cable-pulling rope loop idea in the text.*

HAMSATS

Amateur Radio Via Satellites

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A field of their own

Field Day is once again just around the corner—June 22nd and 23rd. Every year the American Radio Relay League sponsors the event as an exercise in emergency preparedness. Amateur radio groups in the United States and Canada take their ham gear, generators, batteries, and antennas outdoors for the competition. The object is to work as many stations as possible on the amateur bands from 1800 UTC Saturday for 24 or 27 hours (depending on when station setup began).

By the ARRL rules, completing one satellite contact during Field Day earns a 100-point bonus. Contacts via satellite beyond that are lumped together as one "band" and get the same points as other Field Day contacts. Twenty years ago these rules were adequate for the satellites of that time, but today, with a dozen hamsats in orbit, the situation has changed. In an effort to inspire more groups to set up and operate serious satellite stations during the weekend, AMSAT, the Radio Amateur Satellite Corporation, sponsors its own version of Field Day. The dates and times are the same, but there the similarity fades.

The AMSAT competition is to encourage the use of all amateur satellites, both analog and digital. The AMSAT competition is open to all satellite enthusiasts, both domestic and foreign. American and Canadian stations should exchange ARRL section and transmitter-class information. Foreign stations should exchange signal reports and country names. This year CW contacts and digital contacts are worth three points each as outlined below.

1996 AMSAT FIELD DAY COMPETITION RULES:

Analog Transponders

- Each satellite transponder is considered a separate band. This means that AMSAT-OSCAR-13 Mode "S" is separate from A-O-13 Mode "B."
- All phone QSOs and all CW QSOs on a given satellite transponder are considered separate bands. This means that A-O-13 Mode "S" CW is separate from A-O-13 Mode "S" phone.
- Therefore, for reporting purposes, A-O-13 has four possible "bands" including Mode "B" CW, Mode "B" phone, mode "S" CW, and Mode "S" phone.
- All packet/RTTY/ASCII/AMTOR QSOs through analog transponders are counted as CW QSOs.
- Phone QSOs count for one point and CW QSOs count for three points.
- Cross-mode (CW–phone) contacts are not allowed.
- The use of more than one transmitter at the same time on a single satellite transponder is prohibited. This means that two stations at the same Field Day site can operate through A-O-13 at the same time, but only if one is operating Mode "S" and the other Mode "B". If two stations at a given site are set up for Mode "B" operation, only one can be on A-O-13 (CW or phone). The other station can be used for different hamsats (like A-O-10) or other Field Day activities.

Digital Transponders

- For the pacsats (L-O-19, K-O-23, etc.), each satellite is considered a separate band.
- Do not post "CQ" messages. Simply upload ONE greeting message to each satellite and download as many greeting messages as possible from each satellite. The "subject" of the uploaded file should be posted as "Field Day Greetings" addressed to "ALL." The purpose of this portion of the competition is to demonstrate digital satellite communications to other Field Day participants and observers.
- The following uploads/downloads each count as a three point digital contact:

(a) Upload of a Satellite Field Day Greetings file (one per satellite).

(b) Download of Satellite Field Day Greetings files posted by other stations. Other non-Field Day files are not to be counted for the event.

- Satellite digipeat QSOs do not count for any score and the use of gateway stations to uplink/downlink is not allowed.
- The *Mir* PBBS is not to be used for Field Day operations.
- If F-O-20 is active, the JA transponder can be used for analog CW and phone activities under the analog transponder rules, and the JD system can be used as a separate transponder under the digital rules.

Sample Satellite Field Day Greetings File

"Greetings from N5EM Field Day Satellite station near Galveston, Texas, with 24 participating members in the AMSAT-Houston group. All the best and 73!"

Note that the message stated the call and name of the group, where they were located and how many were in attendance.

Operating class and reports

Stations operating portable and using emergency power (as per ARRL Field Day rules) are in a separate operating class from those at home connected to commercial power.

A Satellite Summary Sheet should be used for submittal of the AMSAT Field Day competition results. A copy of this form will be in the AMSAT Journal or can be obtained from me at the address above for a self-addressed-stamped envelope. Deadline for submissions is August 1, 1996.

Competition was tough in 1995 and should be even tougher in 1996. The station submitting the highest score for portable operation using emergency power will receive a plaque at the AMSAT General Meeting and Space Symposium in Tucson, Arizona, November 8-10. AMSAT hopes this event provides satellite operators with the practice necessary to set up a ground station and effectively operate via the satellites in an emergency situation. Remember that Field Day also provides a good opportunity to expose newcomers to the amateur radio satellites. Most of all, it should be a great time! 73

QRP

Number 63 on your Feedback card

Low Power Operation

Michael Bryce WB8VGE
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Massillon OH 44646

More on K1BQT's 15m rig

Last month, we got the transmitter up and running on the 15 meter CW transceiver described by Rick Littlefield K1BQT (*Ham Radio,* January 1989). This month, we'll take a look at the receiving half of the transceiver.

The receiver

Since the receiver is a bit more complex than the transmitter, I've added a block diagram (**Fig. 1**) to guide you though the signal flow. As I mentioned before, I can't reproduce the circuit here.

Basically, the input to the mixer is simple and to the point. A NE602 mixes the incoming signals with the VFO's output. As we saw in last month's column, the front-end mixer also produces the required VFO energy.

Unlike some of the more recent club rigs, like those of the NorCal and NW QRP clubs, the 15 meter rig has four crystal filters. In fact, by matching the crystals, a very tight IF filter is possible. However, I like my CW a bit on the wide side, so no attempt was made to fine-tune this filter. In fact, common computer clock oscillator crystals are used. Digi-Key and Mouser Electronics carry a wide selection. Surplus electronics houses have computer clock crystals in stock as well. Most of the crystals may be had for less than a buck apiece. Pick up a handful; you'll need more than four if you plan on matching them.

After the incoming signal has been mixed and passed through the IF filter, the signal is then applied to an MC1350 IF amplifier. My dealings with this guy have been less than happy!

The MC1350 will easily go into oscillation at the drop of a hat. A common fault most builders have when working with this chip is using an IC socket. The extra lead length combined with the high gain of the amplifier produce all kinds of unusual critters. If you have trouble with an MC1350 and have it installed in an IC socket, remove the socket and solder the 1350 directly to the PC board.

"Most of the crystals may be had for less than a buck apiece. Pick up a handful."

When laying out a PC board, make all the copper traces to and from the 1350 as large as possible. This will keep unwanted inductance out of the circuit. Use a top ground plane if possible; again, keeping inductance down to a minimum.

On this rig, the output of the 1350 is applied directly into an NE602. Here the IF frequency is mixed with the BFO crystal. In my block diagram (**Fig. 1**), I did not show the trimmer capacitor used to net the BFO crystal. Nor did I show the capacitor used to couple the output of the 1350 into the NE602.

Audio

Rick uses a standard audio filter comprised of two op amps. A single 1458 amplifier is used. Rick allows you to select or bypass the filter by a double-throw double-pole switch.

From the audio filter, or directly from the BFO mixer, the audio is fed into an LM386. This 500 mW audio amplifier has become the standard in most QRP rigs. However, in Rick's design, the gain is set high and the volume to the speaker is through an "L" pad arrangement. This is very similar to the design Rick used in the MFJ rigs he designed.

A simple audio-derived AGC controls the gain of the receiver by constantly adjusting the gain of the IF amplifier.

Making the rig work

As with so many projects in various magazines, there are some mistakes in the instructions. Perhaps the most lethal is the lack of interconnections between the relay used for T/R switching and the rest of the circuits.

In the original article there is no mention of how or why the wires should run from the relay contacts to the other parts of the circuits. This one caught even me by the short hairs. Only after spending several hours wondering why the PA was drawing an amp of current without output did it occur to me to trace the output back to the relay. The fix is simple: Use hook-up wire to complete the wiring.

My buddy used computer clock crystals for the IF filter. That's exactly what I said to do. However, in his case the crystals he used were for oscillators used in wristwatches! They just plain did not work in the circuit. The fix? Replace all the crystals used in the filter.

Super-small QRP rigs are a trademark of Rick Littlefield, but most builders don't have access to the vast array of micro parts Rick does. So, to fit some of the silver mica capacitors on the PC board, they must be installed on the foil side. This means that the PC board has to be installed a bit higher off of the metal cabinet. which also means that the leads on the PA transistor have to be a bit longer than necessary.

Another sticky point is that the AGC components are not on the PC board. They are located "sky-wiring style" on the front panel. Without the AGC parts, the gain control to the 1350 is left to dangle. That makes for a rather interesting way to control the gain of a pesky amplifier like the 1350. I got around the problem by supplying the 1350 with enough gain to test out and align the stages. The AGC components will be installed when the circuit board goes into its case.

Building your own version

You might be able to get a PC board for the rig. The original article stated that PC boards were available from RadioKit; I don't know if RadioKit is still around. You might try Far Circuits (18N 640 Field Court, Dundee, IL 60118). Perhaps they have the boards, or the artwork to produce them.

That's all for the QRP 15 meter rig. All we need now is a zillion or so sunspots so we talk to someone else on 15 meters! 73

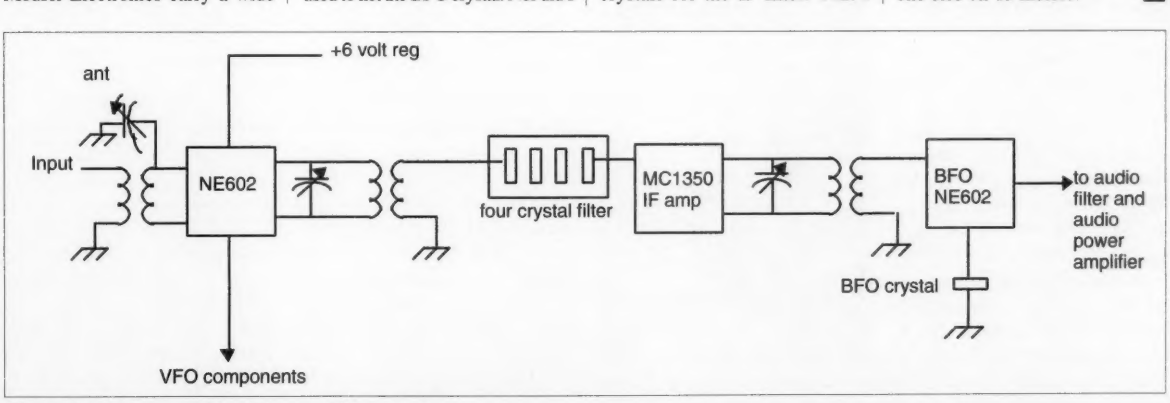


Fig. 1. Block diagram of the 15 meter CW transceiver.

Continued from page 55

MORE NEW PRODUCTS

An Ear Microphone?

Genesys Products Group's Eartalk Mark II combines an earphone and a microphone in their ear unit, picking up your voice via your inner ear. It has a separate PTT switch (with a lock). It's designed for nearly hands-free use with mobile rigs and HTs—no more mike boom out in front of your face. There are models for Icom, Kenwood, and Motorola. The price? $84.95. Geyesys, 10815 Gulfdale, San Antonio TX 78216. Phone (800) 847-4745 or FAX (210) 349-4300. E-mail: genesys@connecti.com.

Proud Addition to MCM's Catalog

Scanning Radios from Uniden America, known worldwide as the leading manufacturer of handheld, mobile, and tabletop scanners, are now being distributed by MCM Electronics.

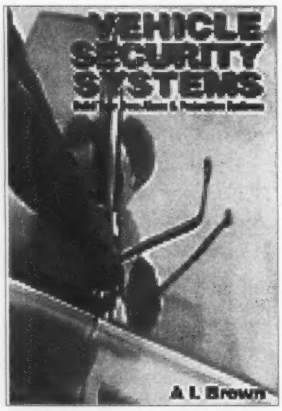
MCM's semiannual catalogs are also widely known, and MCM's distribution centers enable ground-rate shipping to most of the U.S. within 48 hours. 99% of all orders are shipped within 24 hours. For more information and a free catalog, call 1-800-543-4330.

New Lattice Programmable Logic Development Kit for PC

APS announces the release of its APS-L1016 programmable logic development kit. The system consists of the Lattice pDS(r) Design Software and a test board with a Lattice isp1016 in-circuit programmable logic chip and an ispGDS22 programmable switch matrix. The kit allows for the partitioning, place and route, simulation and hardware implementation, all from the PC keyboard, without burning PROMS or changing parts. The kit sells for $250 and is ideal for evaluation and testing of programmable logic.

Contact APS (Associated Professional Systems) by phone (410) 515-3883 or FAX (410) 661-2760, or write to: 3003 Latrobe Court, Abingdon, MD 21009.

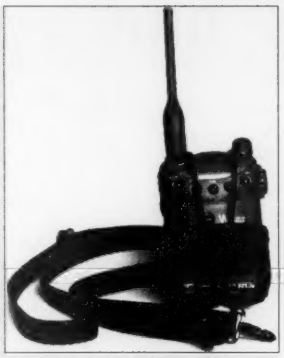
Vehicle Security Systems



A L Brown, Newnes Publishing, 1996, 86pp., $29. The subtitle is: "Build Your Own Alarm & Protection Systems." If you enjoy building small projects, you're going to love this book. It even has the board layouts for you. It covers car and garage and home alarms, delay circuits, ultrasonic, infra-red, and so on.

The security business is still an easy and profitable business to start in your spare time, and experience that independent feeling that having your own business brings. You may win big or you may fail, but no one can downsize you to the unemployment office, or move your job to Mexico...Wayne

Strap That Baby On!



The new "CLC503" padded Cordura nylon carrying case from Standard is made for both the C508A and the C108A mini-handhelds by Standard. It has nylon cord retainers to secure the radio in place, and a loose-weave nylon adjustable shoulder strap, to keep it comfortable slung over a shoulder or around the neck. The CLC503 attaches to a belt, or even stands up on a desk.

Suggested list price is $19.95. See your amateur equipment dealer or contact Standard Amateur Radio Products, Inc. at P.O. Box 48480, Niles, IL 60714. Phone (312) 763-1181; FAX (312) 763-3377; or reach them on the Web at HTTP://WWW.STDRADIO.COM.

New Version of AEA MacRatt – MacRatt™ III

Advanced Electronic Applications, Inc., is now shipping the new AEA TNC control program. It has totally re-engineered the new MacRatt III to take advantage of the powerful features of the newer Macintosh operating systems.

This new software provides users with a simple, multifunctional terminal control program for the AEA TNC. On packet, each station you connect to will have its own adjustable split-screen window. Stream switching is automatic; just click your mouse on the window. A monitor/unproto window will display incoming packets. Unproto packets (to send CQ, for example) may even be sent while connected to others. For those TNCs with PACTOR, AMTOR, RTTY (Baudot & ASCII), Morse, etc., there are convenient interfaces built in to make these modes even more enjoyable to operate. Frequently used commands may be selected for the menus, dialog boxes, and buttons on the windows.

Suggested list price for MacRatt III is $99. Check with your amateur radio equipment dealer for the best price; upgrades for people who currently own MacRatt I or II are available only from AEA for $55.50. For details, call the 24-hour AEA Literature Line at (206) 712-8054; FAX them at (206) 775-2340; mailing address is AEA, P.O. Box C2160, Lynnwood, WA 98036.

New Stinger For Yellowjacket

Cubex proudly announces the Stinger, a new add-on supplement to its popular 2 meter "Yellowjacket" four-element quad antenna. The three-element Stinger is simply added to the director end of an existing Yellowjacket antenna, thus providing a solid seven-element quad antenna with 50% more gain than the Yellowjacket alone, without any special tools or tuning. The Stinger comes with a Fiberglas™ boom coupler and an aluminum boom/mast coupler plate.

The Stinger is $44.95 plus $7 shipping and handling; or $85.50 as a package with the Yellowjacket, plus $9 shipping and handling. It's available from the Cubex Quad Antenna Company, 2761 Saturn St. "E," Brea CA 92621. Phone (714) 577-9009 or FAX (714) 577-9124.

Continued on page 88

Communications Simplified, Part 6

by Peter A. Stark K2OAW
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Now that we've looked at wires and fiber optic cables for communicating, let's look at wireless communications—radio.

Is radio just high power?

Beginning students of communications sometimes think that transmitting a radio signal requires nothing but a lot of power. Are they right? Let's see.

Suppose you try the experiment shown in **Fig. 1.** Here we have a transmitter, which consists of a microphone feeding a high power audio amplifier (such as a hi-fi amplifier), and the output of the amplifier going to an antenna. The receiver is just another antenna, feeding a high gain audio amplifier (such as a hi-fi preamp) which takes the tiny signal received by the antenna, and amplifies it enough to feed a speaker. Would this work?

Some of our more advanced readers may laugh at the idea, but before they jump in, let me give you the answer: "YES! If you do it right."

The catch is that you need a big enough antenna. As a general rule of thumb, an efficient radio transmitting antenna has to be about a quarter of a wavelength long. You can make some compromises and make it smaller, but (except for some special loop antenna designs) this reduces its efficiency tremendously.

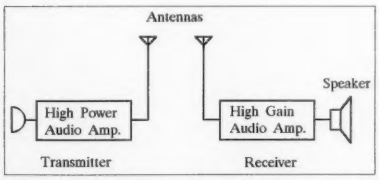

Fig. 1. Would this work for radio?

To transmit audio, let's assume we want to cover the frequency range from 20 to 20,000 Hz. Using the formula for the wavelength at 20 Hz, and using the speed of light in our equation, we get

λ = velocity/frequency = 186,000 miles per second/20 Hz = 9300 miles

An antenna one quarter wavelength long would then have to be 9300/4 = 2325 miles long!

Would it work? Sure, but would it be practical? Of course not! So how are we going to transmit a voice or music by radio?

To make radio practical, we have to shorten the antenna to some more reasonable length, and that requires that we shorten the wavelength. Looking at the above equation, we see that there are only two ways to do that: either reduce the speed of light (hmm...there's an idea there), or increase the frequency.

I suppose we could all learn to talk like the Chipmunks™ but this would not be enough. To reduce the antenna length a lot, we must increase the frequency *a lot*.

The solution to this problem is not to send the voice or music by itself at all, but to send a much higher frequency signal called the *carrier*, and to let the voice, music, picture, or whatever, ride on top of that carrier.

For example, if you look at the dial of an ordinary AM radio, you will see numbers ranging from 540 up to 1600. These numbers represent the frequencies of the carriers for the AM broadcast stations, which (for this type of radio) range from 540 kHz up to 1600 kHz.

One of the radio stations close to our school is WCBS in New York. It is about six miles from our campus, and we can pick up a very strong signal from them. Their carrier frequency is 880 kHz; let's see how long an antenna they need at this frequency:

λ = 186,000 miles per second/880 kHz = 0.21 mile

which is about 1,116 feet. A quarter-wavelength antenna would therefore have to be 1116/4 or about 279 feet long. WCBS's antenna is actually a vertical tower, somewhat over 250 feet tall. Rather than have an antenna mounted *on* the tower, the tower itself *is* the antenna. It is mounted on insulators, so it acts as a giant pole, pointing up to the sky.

Modulation

The process of putting our signal on a carrier is called *modulation*. In the transmitter, it is done by a *modulator*, and in the receiver our desired signal is removed from the carrier by a *demodulator*, also called a *detector*.

The carrier itself is a high frequency sine wave. Although the carriers for the standard AM broadcast stations are in the range of 540 to 1600 kHz, carrier frequencies can be much lower as well as much higher. The US Navy operates some transmitters with carrier frequencies about 10 kHz; on the other hand, microwave transmitters often have carriers above 10 GHz—that is more than 10,000,000,000 Hz.

Modulating a carrier involves changing it in step with the signal (voice, music, picture, or whatever, but we will talk only about audio for now) that we want to send. Since the carrier sine wave has a frequency, an amplitude, and a phase, any of these three can be changed with

modulation. When we change the amplitude, we produce *amplitude modulation* or AM, changing the frequency produces *frequency modulation* or FM, and changing the phase produces *phase modulation* or PM. We will begin by looking at AM, and leave FM and PM for later.

Amplitude Modulation (AM)

All of the radio stations on the standard AM broadcast band use amplitude modulation, a method which dates back to the very beginnings of radio.

Fig. 2 shows a sample of amplitude modulation. At the top, we see a typical audio signal. Underneath it is the *unmodulated carrier*, a plain sine wave with a much higher frequency than the audio signal; at the bottom is the carrier with the audio modulated onto it. Note how the modulated carrier (bottom waveform) becomes bigger when the audio is positive, and becomes smaller when the audio is negative. If the audio wave is near zero volts (right in the center of the audio wave), then the modulated carrier is the same height as the unmodulated carrier.

If you take a pencil and carefully connect the tops of each cycle in the modulated carrier, you get a curve that looks just like the audio signal. This is the dark curve in **Fig. 3**, and it is called the "envelope."

The modulator in the transmitter takes the audio and uses it to vary the amplitude of the carrier; the demodulator (detector) in the receiver then uses the envelope of the carrier to recover the audio, and throws the carrier away.

A simple AM receiver

Fig. 4 shows the diagram of a very simple AM receiver, called a *crystal radio*, that can be built at home with just a few parts. The unique thing about it is that it needs no battery or power supply, and so provides absolutely free radio reception, but since "there is no such thing

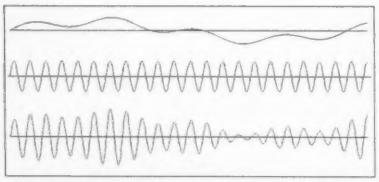

Fig. 2. Audio, carrier, and AM modulated wave.

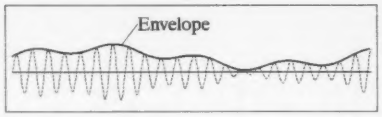

Fig. 3. The envelope.

as free lunch," there has to be a catch. The catch is that the radio really does need some power, and that power has to come from the radio station. This radio will only work if you are close enough to a radio station to receive a strong signal.

The antenna, a long length of wire preferably strung somewhere outside the house (but away from electric power wires), picks up many different signals, including AM and FM radio stations, TV stations, taxi and police radios, and more. The first thing to do is to remove the stations we don't want, and keep only the one we do want. This is done by a tuned circuit consisting of the antenna coil and the 365 µF variable capacitor; the antenna coil acts as both a transformer and an inductor in the tuned circuit.

Years ago, these two components were very easy to get in almost every radio store; today they are hard to find. Suitable replacements can be made from more modern parts, but it is probably easier to buy a commercial crystal radio kit, such as the one from Radio Shack™ (which uses a slightly different circuit, but it works the same way). When the right coil and capacitor combination is used, turning the capacitor from one end to the other will tune the radio through the 540 kHz to 1600 kHz range of the AM broadcast band.

Ideally, the output from the tuned circuit should contain only the modulated carrier from the one station we are tuned to; alas, that's not the way it usually works out. A single tuned circuit is usually not good enough to keep one station and remove all the others; a normal radio needs several tuned circuits working together to accomplish that. What usually happens in the crystal radio is that we have the one desired station, plus the signals from a few adjacent stations. If the station we want is strong and the others are weak, then the radio will work well, but if the desired station is weak and the others are strong, then we might as well give up—we will not be able to hear the station we want.

The modulated carrier is now sent to the diode. Since a diode conducts in only one direction, only half of the signal gets through it. In this case, only the positive peaks of the carrier make it through the diode. When these peaks hit the 0.001 µF capacitor, they charge it up (if you're familiar with power supplies, then you can think of the diode as the rectifier, and the capacitor as the filter which charges up to a DC value and removes the ripple). The capacitor basically charges to the voltage of the envelope. The voltage of the envelope keeps changing in step with the audio, and so the capacitor voltage also keeps changing. This voltage is then sent to the headphones.

Although the crystal radio circuit looks simple, actually all the components have to be just right, or it will not work properly. For example, the antenna coil and capacitor must be the right values to tune to the band; the ratio of turns also has to be right to give the maximum signal. For best reception, the diode should be a germanium diode, not a silicon one which needs more voltage to operate. The capacitor value is also somewhat important—it has to be large enough so it removes the carrier, but small enough so that it doesn't remove the audio signal (Actually, the radio will even work without this capacitor, but not quite as well). Even the headphones must be chosen carefully. They must have a high resistance (1000 ohms or more) to prevent shorting the signal; that means that the kind of headphone usually supplied with the "walk-person" type tape players will not work. In their crystal radio kit, Radio Shack omits the 0.001 µF capacitor, and uses a crystal headphone which has a very high resistance.

This kind of radio is called a crystal set because of the diode. Some 60 years ago, when crystal radios were very popular, tiny germanium or silicon diodes were not even invented yet. Instead, the crystal set used a small piece of galena crystal and a "cat's whisker."

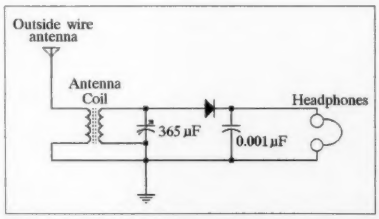

Fig. 4. A crystal radio receiver.

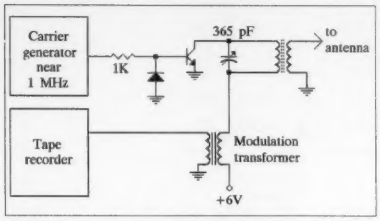

Fig. 5. A simple AM transmitter lab experiment.

The cat's whisker was a thin, springy wire which pressed against the galena to form a diode junction, and then was attached to a small handle with a knob. You had to probe the crystal to find a "hot spot." Tuning and adjusting such a radio was almost an art (and a lot of fun!)

A simple AM transmitter

Now that we see how the AM receiver works, let's see how the transmitter works. **Fig. 5** shows a simple circuit that our students wire in lab.

Rather than wire up our own oscillator, we use a commercial signal generator to generate a carrier. Our students first use a portable radio to find a clear spot on the dial, and then tune the generator to that open frequency, which is usually near 1 MHz.

The signal generator is fed to the base of the transistor. Since the transistor has no base bias, it only conducts when the generator's output is sufficiently positive (above about 0.7 volts) to bias it on. Thus, the transistor conducts only some of the time. But when it does conduct, there is enough voltage and current in the base to turn it on all the way.

The transistor, therefore, behaves like a switch, which is turned on and off roughly 1,000,000 times per second. This applies a square wave on-off current to the tuned circuit at the carrier frequency. As we have seen in previous installments, a square wave consists of a fundamental frequency plus harmonics. But the tuned circuit gets rid of the harmonics, so the signal going out to the antenna should (hopefully!) be just a sine wave at the carrier frequency.

The size (amplitude) of that sine wave depends on how much voltage gets switched by the transistor. Although the collector voltage supply is shown as +6 volts, the modulation transformer in series with the DC input changes that. When we play a tape on the recorder, the audio signal sent to the modulation transformer is alternately positive and negative, varying in step with the audio. The secondary voltage on the transformer is therefore also alternately positive and negative. When it's positive, it adds to the +6 volts to produce more voltage (and a bigger output carrier signal), and when it's negative, it subtracts from the +6 volts to produce less voltage (and therefore a smaller output carrier). In other words, the audio signal from the modulation transformer amplitude modulates the carrier.

Modulation percentage

There is a limit to how big that audio signal can get because when the transformer output reaches -5.9999 volts (or approximately -6 volts), it subtracts from the +6 volts to give almost zero; at this point, the signal becomes so tiny that it almost disappears. If the transformer output were to get even more negative (such as -7 or -8 volts), the collector would go negative, and the carrier would be shut off completely for a while.

The point where the signal just barely disappears is called 100% modulation, and is the maximum that we can vary the amplitude. At this point, the transformer output would have a maximum (peak) amplitude of ± 6 volts, so that the collector voltage would vary from its normal +6 volts all the way down to 0 volts, and up to a maximum of +12 volts.

100% modulation is a technical limit on how much you can modulate, but it is also a legal limit. If you tried to modulate more than 100%, your carrier would alternately go on and off; this would create a lot of interference to other stations, and the FCC would go after you for improper operation of your transmitter.

Fig. 6 shows a carrier with three different amounts of modulation: 0% (which is no modulation at all), 100% (which is the maximum permitted), and 50% (which is halfway between).

Actually, 100% modulation is just barely permitted, since it does cut off the carrier for an instant. Most AM transmitters are set up so they will use a maximum of perhaps 95% or 98% modulation, just to avoid the possibility of accidentally going over 100%.

Let's take a closer look at **Fig. 7**, which shows some unknown percentage of modulation. How can we figure out the actual percentage? It's actually quite simple. First, note that the maximum carrier voltage (called V_{max}) is 21.1 volts, while the minimum carrier voltage (called V_{min}) is 3.7 volts. Assuming symmetric modulation (meaning that the audio signal goes up the same amount as it goes down), this would place the average carrier voltage without modulation (shown as V_c at the left) halfway between the maximum and minimum. This is the average voltage, found from:

$V_C = V_{max} + V_{min}/2 = 21.1 + 3.7/2 = 24.8/2 = 12.4$ volts

At the peak of the modulation, the voltage goes from 12.4 up to 21.1, which is an increase of (21.1 - 12.4) or 8.7 volts. At the valleys, the voltage goes from 12.4 down to 3.7, also a decrease of (12.4 - 3.7) or 8.7 volts.

To find the modulation percentage, we have to ask this question: A drop of 8.7 volts is how many percent of the maximum possible drop? The maximum possible drop (which is 100% modulation) is 12.4 volts, so 8.7 volts is what percentage of 12.4 volts? The formula is

8.7/12.4 x 100% = 70%

So **Fig. 7** shows 70% modulation.

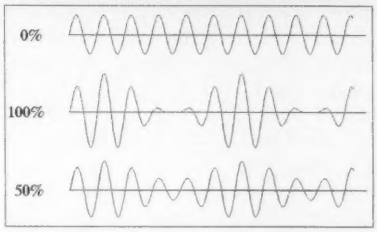

Fig. 6. Three different modulation percentages.

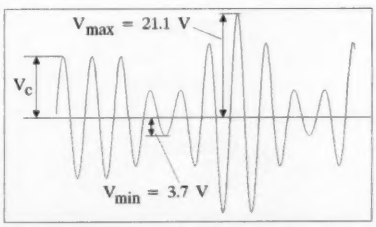

Fig. 7. Calculating the modulation percentage.

DETOUR

If you have, or can use, a PC-compatible computer, the following program lets you see a carrier with different percentages of modulation. It's written in Basic, and can run with either IBM Basic, GWBasic, QBasic, or Quick Basic:

```
10 'Program to display AM
20 PERCENT = 70 'Enter
percent here
30 SCREEN 2 : PRESET(0,100)
40 FOR X=0 TO 639
50 CARRIER = SIN(X/5)
60 AUDIO = SIN(X/50) *
PERCENT/100
70 TOTAL = (1 + AUDIO) *
CARRIER
80 Y = 100 + 40 * TOTAL
90 LINE -(X, Y)
100 NEXT X
110 IF INKEY$="" THEN 110
120 SCREEN 0
```

Enter the desired modulation percentage in line 20, and then run the program.

Line 30 of the program puts the display into graphics mode, and positions a black dot halfway down the left side of the screen. Lines 40 through 100 set up a loop to plot 640 dots across the width of the screen.

At each of the 640 positions, line 50 calculates a carrier voltage, line 60 calculates the audio (modulation) signal, and line 70 puts them together. By multiplying the two, it uses the value of the audio voltage to set the height of the carrier, and finally lines 80 and 90 calculate the height of the point on the screen and plot it.

END OF DETOUR

The BEARS Hunt the Fox

Motivate, mobilize, and make it fun!

Pete Kemp KZ1Z
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Bethel CT 06801-1594

Looking for a great hands-on activity to motivate your students? Try a foxhunt! This multifaceted event encourages students to organize, research, experiment, construct equipment, and, most importantly, to have fun.

The Bethel Educational Amateur Radio Society, the BEARS, sponsored by the Technology Education Department of the Bethel Middle School, is designed to provide co-curricular amateur radio activities for our community's youth. It's an amateur radio organization in which the students are the primary focus and the adults serve as advisors.

The BEARS students constructed 2-meter loop antennas and learned about both foxhunting techniques and the importance of attenuators. The area was evaluated for good hiding places, sweep/search patterns were visualized, and a variety of safety-related issues were discussed. A group of students developed the rules and, on the appointed day and time, the foxhunt began.

"Some parents who came by to watch have since become licensed themselves, expanding the number of ham families in our community."

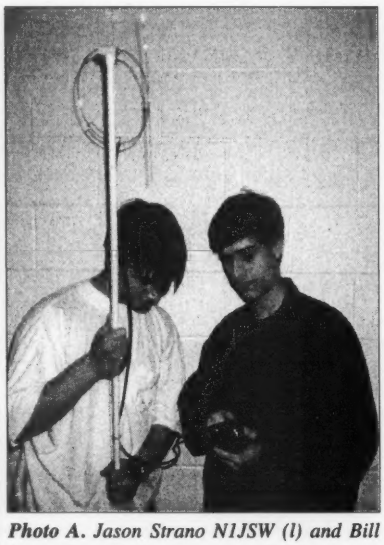

Photo A. Jason Strano N1JSW (l) and Bill Noyce N1LGU (r) check out a DF loop.

Many of the students got into the spirit by wearing military and camouflage clothes, which provided some hikers in the area with quite a thrill. Seeing the bustle of activity, they actually thought that this group was on a real search-and-rescue mission! Many people stopped by the Command Center to ask questions, and to request information on amateur radio licensing and classes.

The Fox Team was given a 15-minute head start. They used a dual-band HT for 2 meters and 220 MHz and a variety of antennas, from stubby ducks to a full-waver. They also had extra battery packs. The BEARS maintain the local 224.32 MHz repeater, so we were able to use 220 MHz as a backup and to coordinate events behind the scenes in case any problem cropped up. The 224.32 repeater has an autopatch, so we would be able to contact parents or emergency services if necessary.

It is important that a Fox Team have speaker-microphones or headsets, as in-close foxhunts require sharp hearing and you don't want to give away your position by talking loudly. While the Fox Team was getting ready to settle in, a Committee is currently looking into new locations, encouraging students to construct or upgrade their equipment and foxhunting knowledge. All participants received a Certificate of Participation, which noted that this type of event

"This multifaceted event encourages students to organize, research, experiment, construct equipment, and, most importantly, to have fun."

review of rules took place, maps of the area were passed out, and an opportunity to address any last minute questions or concerns was provided.

In the interest of personal safety, all teams were comprised of three or four members. The more teams the merrier! Younger BEARS members were assigned to teams with at least one adult member.

The hunt is on!

With the Fox Team safely hidden in the woods, the intrepid BEARS Foxhunter Teams took off in hot pursuit, antennas banging into tree branches and flying in all directions, each team wanting to be the first to trap the fox—nothing like a little pumped-up motivation to get this activity off on the right foot. This will also do wonders for one's cardiovascular conditioning.

Listening to the radio communications on simplex was quite humorous at times, with a seemingly endless stream of requests for the fox to send out transmissions and the fox replying with cryptic clues, in addition to taunting the hunters. It took nearly an hour, but the foxes were eventually captured. In the end, common sense pulled it out for the winning team. When the signals began to swamp their receivers, some participants removed their antennas completely and ran around the area, pointing their HTs in all directions, frustrated by the fact that they knew they were closing in on their prey. The foxes were hiding in plain sight, in the prone position, their camouflage clothing blending in with their leafy surroundings. The winners actually found the fox when they stepped on him! Within the next 10 minutes all teams were on target and accounted for.

Tired, hot, and physically exhausted, the first comment made was "CAN WE DO IT AGAIN?" You bet! The Foxhunt supports skills that could be used by our local RACES/ARES organization.

Since our foxhunts began in the woods four years ago they have continued to garner a loyal following, with as many as eight teams participating. Doug Griffin WA1KRX put together an excellent "Foxhunting Basics" handout and has made presentations to the students, always allowing plenty of time for full question and answer sessions.

This activity is just the type of involvement that is readily accepted by youthful amateurs and students interested in our hobby. By taking full advantage of their needs, it provides a perfect way to acquire practical amateur radio experience, and have a good time as well. An additional bonus was that some of the parents who came by to watch the fun have become licensed hams, adding to the ever-increasing amateur group in our area. Having a parent become a licensed amateur offers a number of benefits to a child. It enhances a healthy parent/child relationship, and the student is assured of getting additional equipment as well as the opportunity to get that antenna hoisted up just a bit higher. This connection also provides the school club with additional human resources; chaperones and supervisors for future events, such as Field Day, simulated emergency tests, and other public service/training events.

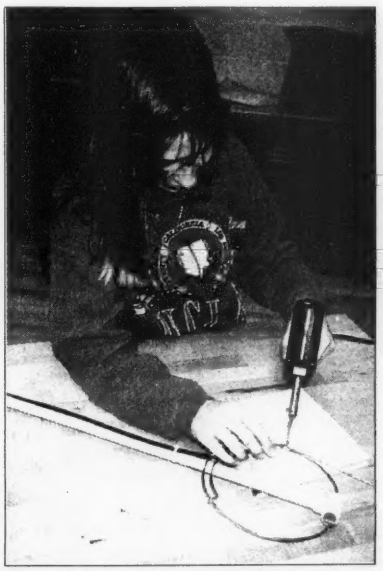

***Photo B.** Elizabeth Noyce N1OAN soldering a VHF loop antenna in preparation for a foxhunt.*

***Photo C.** Dan Settanni N1MFG (l) and Bill Noyce N1LGU (r) test a commercially constructed DF unit.*

Dealing With Doublespeak

Interpreting those befuddling transceiver spec sheets.

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Interpreting the specifications sheets used by ham radio equipment manufacturers to describe the technical advantages of their radios can often be a trying exercise. It seems as though the manufacturers have gone overboard to make them sound impressive, but it's sometimes tough to ferret out the *real* information. Mass-marketing techniques have definitely invaded the Hallowed Halls of ham advertising, using glitzy ploys previously associated with the guy or gal on-the-street consumer markets! As this trend grows, it's even more important for all of us to understand some of the finer points in the interpretation of technical specifications—more so than in years past.

Keep in mind that this treatment is intended to help clarify the numbers and acronyms used to describe amateur transceivers, not to make matters worse! So I'll attempt to use non-intimidating, readily understood terms—which, to some, may seem incomplete—but which, hopefully, will be understood by those at whom the article is aimed.

"If connecting a resonant antenna results in a background noise increase, a preamp will only bring up more background noise."

The following list contains most of the parameters quoted in the bulk of the transceiver manufacturers' technical spec sheets. I hope that I've covered those important for making purchasing and/or operating convenience decisions, but inevitably someone's favorite will be left out. Let me know—calmly, please—if that's the case.

Sensitivity

Sensitivity is a figure applied to radio frequency receivers indicating how little signal is needed at the set's antenna terminals (or coax input connector) for a minimum incoming signal to be at least "mostly" readable. It's usually referenced against so many decibels of quieting above the noise—generally 10dB. Since sensitivity is given as a voltage figure, 0.25µV for 10dB signal-to-noise ratio means that 1/4 of a microvolt at the antenna connector will produce a signal a little over 3 times the level of the background noise, a fairly typical figure. 6dB would represent a doubling of the voltage, 12dB a quadrupling of it, so 10dB would fall toward the high side of in-between, or 3.17 times.

Important: A dB of power is different from a dB of voltage; in power terms, 3dB represents a doubling and 6dB, a quadrupling of the power. In voltage terms, remember, 6dB represented a doubling and 12dB a quadrupling of the voltage (as mentioned in the previous paragraph). Nice of them to do that, but actually it's unavoidable, because power is the product of voltage and current. I mention it here so that it's not a surprise when we start to talk about power shortly.

Keep in mind that an increase or decrease in decibel terms is a ratio, and purely a logarithmic ratio, rather than a linear relationship. I think that's why many people shy away from using the dB concept, but it's not really that difficult. Using logarithmic ratios has two distinct advantages: Our senses work on a more-or-less logarithmic scale, and logarithms can be added together with the result being the same as if we had multiplied the actual numbers represented by the logarithms. Take a quick look at the sidebar chart to see how the logarithmic ratios for power and those for voltage relate. The chart also shows why it's important to figure out if the specs are speaking in terms of power or voltage, because the numbers can change quite a bit depending on the choice...and it's not always made totally clear by the specification writer.

Sensitivity, by the way, like most good things, can be overdone under certain local listening conditions. For instance, if you have a ham neighbor nearby, too much receiver sensitivity can result in overload products being developed—and those products are developed within your own receiver if it's too sensitive! In other words, a more sensitive receiver can usually be overloaded more quickly than a less sensitive one; that's the purpose of the attenuator switch found on many sets. It allows a person to deliberately make the receiver temporarily less sensitive—by a fixed number of decibels—if an overload is anticipated or is already taking place. Sometimes the RF gain control can also be effectively used for the same purpose or in conjunction with the attenuator switch.

Another point that's sometimes overlooked with regard to sensitivity is that if the background noise, with the antenna connected, is already above the noise generated within your receiver, more sensitivity won't help. It will only increase that external background noise even more. If connecting a resonant antenna to your receiver increases the noise from the speaker, then you probably won't benefit from additional sensitivity. Most modern receivers and transceivers generally have enough gain in the HF (below 30 MHz) portion of the spectrum so that they don't need additional help. Here are some of the common figures you'll see for a modern receiver or transceiver in the area of sensitivity (all for a 10dB signal-to-noise ratio): 1µV (1 microvolt) is common below the AM broadcast band,

4µV within the AM broadcast band and .25µV above the AM broadcast band through 10 meters. VHF and UHF receivers will sometimes benefit from some help, such as might be attainable via a low-noise preamp, because internally generated noise is more a problem at these frequencies. Again, it also depends upon the amount of local "normal" background noise present. 0.2µV or better in a 2 meter receiver is reasonable, but the lower the noise generated in the RF amp or preamp itself, the better. GaAsFETs are good performers in the VHF/UHF ranges and add-on preamps will usually be rated as so many dB of gain at such-and-such dB noise figure. Again, the lower the noise figure, the better; it's usually more important than gain at these frequencies. Obviously, though, an amplifier must have *some* gain to be an amplifier. A GaAsFET preamp will probably have less than 1dB noise for 15dB gain. So if connecting a resonant antenna results in a background noise increase, a preamp won't do anything other than bring up the background noise some more. The only time that this might be advantageous is if your receiver's AGC (Automatic Gain Control) circuitry is somehow lacking. In some receivers, more front end gain will improve the "AGC action," that is, the ability of the AGC circuit to maintain a "constant" output level with widely varying input signals. I've run into this in a couple of specific receivers. It may be due to insufficient RF gain, IF gain, or a problem in the design of the AGC circuit itself, but whatever the reason, adding a preamp can be a "quick fix" for a more complex design problem.

"Even a chain-link fence in the near field pattern of your antenna can generate harmonics, and they can be picked up on other frequencies!"

Selectivity

Selectivity is the figure used to indicate how well a receiver is able to separate one nearby signal (nearby in frequency) from another. It's usually determined, in modern sets, by the bandwidth of the crystal filters installed in the receiver's IF circuitry. These days they're pretty good. On SSB, the voltage gain may be down 6dB (a factor of 2:1) at 2.5kHz, while at 4.5kHz, it's probably down some 60dB (a factor of 1000:1). This is called "skirt selectivity," because the sides of the response curve slope downward much like the shape of a woman's skirt. The faster the slope, the better. Mini-skirts are better yet—no, that's another thought!

Narrower-than-normal filters are usually offered as options for "improved" CW, AM and SSB selectivity in today's transceivers. Keep in mind that "improved" selectivity means narrower frequency response and more critical tuning, so they may not seem to be improvements from every user's standpoint. Tighter selectivity will cut down on interfering signals, without question, but they also alter the "naturalness" of the final sound to some degree—sometimes to too great a degree, but it's a personal preference. IF shift—shifting the received signal within the receiver's intermediate frequency passband—is another, often less drastic way to cut down on interference. To my ear it's not as "limiting" as tighter selectivity for SSB reception. It's an arguable point. I'm not a big fan of reduced selectivity for the voice modes, because of the limitations on intelligibility, but for CW and Data, it's often a "must" on our crowded HF ham bands.

Emissions and harmonics

Spurious emissions and harmonic content refers to the number and strength of harmonics or other unintended (unwanted) signals emanating from a individual's transmitter. Most modern transceivers are quite good, listing figures of more than 40 to 50dB down in terms of harmonic output. It's a power ratio, by the way, so -40dB is 10,000 times down; -50dB would be 100,000 times down from the rated output power in watts. That translates into .01 watt (10 milliwatts) to .001 watt (1 milliwatt) of harmonic output for a 100 watt transceiver. They have to be that good to pass FCC guidelines for sale in this country, but there are things that a ham can inadvertently do to "degrade" the manufacturer's attempts to keep these unwanted products as low as possible.

Keep in mind that anything added to the transmission line after the basic transmitter or transceiver—such as an SWR bridge or a linear amplifier—can degrade those figures. SWR bridges have diodes that can sometimes create harmonics that weren't there before, and amplifiers can run nonlinear if overdriven to varying degrees. Need something to keep you awake nights? Even rusty crossover points in a chain-link fence, in the near-field pattern of your antenna, can generate harmonics by iron oxide diode action, and they can be picked up by nearby receivers tuned to other frequencies! It is incumbent upon the licensed operator to correct or minimize unwanted emissions, regardless of origin.

Spurious response

Spurious response is the measure of a receiver's ability to handle a strong local signal and to not generate unwanted byproducts as a result of that exceptionally strong signal. Take another look at the discussion on receiver overloading under the topic of sensitivity above. There are inherent design approaches that a receiver manufacturer can take—including the choice of components in the first stages (the RF amp and mixer stages) of the receiver—to minimize this

Specifications

General

Rx frequency range: 100 kHz - 30 MHz

Tx frequency ranges: 160 -10m amateur bands only

Freq. Stability: < ± 10 ppm (-10 ~ +50°C)
< ± 2.0 ppm (0° ~ +50°C) w/TCXO-4
< ± 0.5 ppm (0° ~ +50°C) w/TCXO-6

Freq. Accuracy: < ± 7 ppm (except FM, < ± 500 Hz)
w/TCXO-4: < ±2 ppm (FM < ± 460 Hz)
w/TCXO-6 < ± 0.5 ppm (FM < ± 500 Hz)

Operating temperature Range:(-10° ~ +50°C)

Emission modes: LSB, USB, CW, FSK, AM, FM

Frequency steps: 0.625/1.25/2.5/5/10 Hz for SSB, CW, RTTY & Packet; 100 Hz for AM and FM

Antenna impedance: 50Ω unbalanced

Power consumption:

Input	Rx (no signal)	Rx (signal)	Tx (100W)
100-125 VAC	70 VA	80 VA	550 VA
200-240 VAC	80 VA	90 VA	600 VA
13.8 VDC	2.4 A	2.8 A	19 A

Supply voltage: 100~125, 200~234 VAC, 50/60 Hz

Dimensions (WHD): 410 x 135 x 347 mm

Weight (approx.): 15 kg. (33 lbs)

tendency. IF rejection and image ratio are included under this general heading, though they may be stated separately, and good figures (in voltage terms) are -70dB or better, which is in the order of a 3000:1 reduction, voltage-wise.

Other parameters

Squelch sensitivity used to be generally thought of in terms of FM receivers only, but many SSB/CW receivers today also have squelch capabilities. In general, squelch sensitivity refers to the minimum signal required to "open" the receiver's squelch circuit, allowing the operator to hear a call from another station. The setting of the squelch control itself, of course, will also affect the ultimate sensitivity of the receiver to "open up" upon the presence of a valid signal, but the absolute minimum signal needed is a factor that's built into the receiver's capabilities. Many show figures of .25μV (1/4 of a microvolt) or less, which is quite sensitive.

"The human factor counts—some mikes sound very different depending on who's speaking."

Carrier suppression refers to how far down the unwanted carrier, in single-sideband, is from the carrier in, say, the CW key-down position. Getting rid of as much of the carrier as possible is the idea, since the carrier contributes nothing to an SSB signal, other than perhaps more QRM if it's too high. Today's balanced modulators easily cut the carrier down to -40dB or more, a factor of 10,000:1 or better. That's still .01 watt (10 milliwatts) of carrier for a 100 watt transceiver, which explains why you'll often hear some carrier from a nearby station.

Unwanted sideband suppression is pretty much a factor of the selectivity of the fixed crystal filter used to filter out the unwanted sideband in an SSB signal. It's done at a low power stage and generally runs better than -40dB, about the same as the carrier suppression. And for the same reason as good carrier suppression is important, good sideband suppression lowers unnecessary QRM on the bands.

Frequency stability is generally very good today, compared with the Tube Era, but it still varies from one transceiver model to another. Within plus or minus 200Hz over a 30-minute period and plus or minus 30Hz thereafter are common figures. The less drift, obviously, the better, but you must reasonably expect *some*. Individual transceivers of a particular model number may be slightly better or worse; the manufacturer publishes averages. Keeping the transceiver cool with adequate air circulation helps a great deal. Power supply regulation can also be a factor, when using an external power supply, but today's voltage regulators are excellent as long as the supply isn't overloaded. Battery operation, without the benefit of recharging the battery, may be one area where frequency stability can suffer, even today. You can reach a point where the regulators in the transceiver no longer have enough "head-room" voltage to work with—I've heard it a few times from stations running from emergency battery power only.

Microphone input sensitivity and impedance are two specifications that are sometimes glossed over, but they can be important if you're not using the microphone made to match a specific transceiver. Here's why: Amateur transceivers can vary a fair amount in their audio input impedances. Back in the all-tube era, ham transmitters had "high impedance" mike inputs—100k to 1 megohm. The switch to solid-state transceivers saw mike inputs in the "medium impedance" (2k to 10k ohm) and "low impedance" (500 to 2k ohm) ranges; most fall into the "low impedance" spread these days. Transceivers also vary in their input audio sensitivity, from -80dBm to perhaps as high as -20dBm (dBm is a standard of 1 milliwatt into 600 ohms). Of course, the mike plug, its wiring, and whether the audio "ground" and PTT "ground" are the same point within the transceiver's internal circuitry will vary from manufacturer to manufacturer.

Often, the choice of microphone can make a substantial difference. It depends upon the frequency response of the mike itself, the internally-determined audio frequency response of the transceiver and the individual voice characteristics of a particular operator. How the operator handles the mike (mouth-to-mike distance and the strength of his voice) are also factors; some mikes sound quite different when "close-talked." All of the other specifications we've mentioned are moot if the person on the mike can't be heard at the other end of the circuit!

If you intend to use an existing mike with a new transceiver, it's best to check the specs of the new radio against those of the existing mike to be sure that they're compatible from an output level and impedance standpoint. An *exact* impedance match isn't necessary, since most transceivers have a microphone gain control to compensate for inequalities in the various mike outputs and human voice-loudness differences, but you'll need to be in the right ballpark. It's also important to have the correct DC voltage available at the mike connector for driving an electret mike's built-in FET preamp, if that's the type of mike you intend to use.

Audio power output and impedance indicates the amount of audio driving power that can be expected to be developed into a particular speaker load impedance without developing more than a certain percentage of distortion. A typical figure for an HF transceiver would be 1 to 1-1/2 watts, at 10% or less distortion, into a 4-ohm speaker. That will fill your shack with more 20 meter chatter than you'll probably tolerate for very long! Hand-held transceivers will put out only a half watt or so of audio at 10% distortion, but it's enough to make the small internal speaker in an HT begin to rattle. Audio power, output power, and impedance are more important if you intend to run extension speakers to other locations, or if you're using a relatively inefficient external speaker that may require more driving power.

Final power is something that shouldn't be confusing, but often is. In HF transceivers, it's usually given in PEP (Peak Envelope Power), input power in watts for SSB, and DC input power in watts for CW, FM and AM. Some VHF/UHF transceivers have chosen to state the output wattage instead. In cases where the RF power is stated in input terms, the output to your antenna (or linear amp) will generally be only 50 to 60% of that input figure; that's the conversion loss experienced between input DC power and output RF power. A transceiver that quotes 200 watts DC-CW key-down power input will actually read about 100 to 120 watts on a

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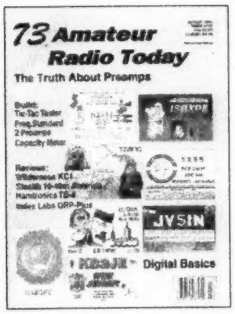

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WATTAGE	VOLTAGE
+100dB = 10,000,000,000	+100dB = 100,000:1
+90dB = 1,000,000,000:1 (1 billion to 1)	+90dB = 31,700:1
+80dB = 100,000,000:1	+80dB = 10,000:1
+70dB = 10,000,000:1	+70dB = 3,170:1
+60dB = 1,000,000:1 (1 million to 1)	+60dB = 1,000:1
+50dB = 100,000:1	+50dB = 317:1
+40dB = 10,000:1	+40dB = 100:1
+30dB = 1,000:1 (1 thousand to 1)	+30dB = 31.7:1
+20dB = 100:1	+20dB = 10:1
+10dB = 10:1	+10dB = 3.17:1
0dB = 1:1	0dB = 1:1

Table 1. *This chart might be a handy thing to keep nearby for the numerical ratios you'll need to know.*

wattmeter connected directly to its output, when the transceiver is connected to its proper terminating impedance (usually 50 ohms). The FM and AM outputs are often considerably less. By the way, the FCC considers you responsible for knowing your output PEP (Peak Envelope Power)...if you're operating anywhere near the legal limit—and the legal limit is just 200 watts PEP on certain bands and subbands. Peak Envelope Power output is different (greater) than CW key-down power output; it must be measured because of differences in individual voices, speech circuits, speech processors, microphones, etc. Take a look at a recent copy of the FCC Rule Book for the entire story. Peak Envelope Power must be read with a scope or a PEP meter. The average wattmeter may not be fast enough to catch the peaks in the RF envelope.

Power requirements will either be quoted in terms of 120 volts or 240 volts AC, at so many watts, in the case of a transceiver with a built-in AC power supply. For transceivers intended to work from "12 volts DC," the normal CW key-down amperage will be given for the transmit mode and the "normal listening level" current for the receive mode. Make sure that the 12 volt power supply (if one is used), its wiring, fuses, and any connectors in the circuit will safely carry the expected maximum current drain.

Here's another point to keep in mind: The commonly used term "12 volts DC" probably means 13.8 volts DC. Why? Because 13.8 volts is what a fully charged lead-acid (automobile) battery can be expected to deliver. During charging, that figure may rise to 14.4 volts. It's important because if that is the voltage level that the manufacturer uses in his specifications, then your fixed-station, low-voltage, high-current power supply should also deliver that 13.8 volt figure. Some transceivers won't regulate properly internally with much less in the way of terminal voltage. Try to measure the transceiver's input low-voltage right at the rear apron power connector, under full CW key-down load, to give you a better idea of the true DC voltage input.

Et cetera

Most of the other specs listed in the literature are more or less obvious, transmit/receive frequency range, antenna impedance, modulation type/s, number of IF conversions and the IF frequencies used, etc. They rarely require much translation. Most of us get hung up on the decibel business, so I've concentrated on those specifications more, with others that I felt were of importance added to the discussion.

Some additional thoughts

It's possible that some of the most important specifications aren't even given...at least those that I feel are pretty important. I'd like to see a typical frequency response curve for the transmitter's audio section, so that I'll know where to start if I receive reports dio sounds "tinny," or too "bassy." On the same topic, I'd like to see a response curve for the receiver's audio circuits. I've heard of receivers that can cause operator fatigue, over a long operating period, simply because their receiver audio chain wasn't designed for overall listener comfort. I would also like to see a figure on the minimum DC input voltage that's allowable into a transceiver, when the internal voltage regulators begin to lose control, as discussed under the power requirements section above. More information on AGC attack times and recovery rates would also be helpful—these are usually only apparent after operating a transceiver for a while. Smoothness of tuning and accessibility of often-used controls are also important features. The "logic" of how memories are stored and retrieved can make operating any particular transceiver either a pleasure or a chore (there are those of us who still like a button that does just one thing, and is clearly marked as to what that one thing is).

Admittedly, some of these are "human-engineering" issues, which are often difficult to phrase for data sheets, but they're issues that can make or break a particular model's acceptability in the "real-world" marketplace. Rest assured that the manufacturer will inevitably promote the best features and avoid those that might prove to be embarrassing; I suppose that's only natural.

Phrases like Auto Correlation and Adaptive Digital Filtering are just now beginning to appear in advertising literature, but be prepared for an onslaught of new multi-initialed acronyms...then try to understand what they're really saying. The smoke hasn't begun to clear yet, but I hope that the various transceiver manufacturers can get together on what to call things and on what are the issues important to the rest of us out here. Until then, the Decimation Aliasing and Correlation Products will keep us Quantizing the transceiver ads! Rough translation: We'll keep trying to wade through the number of confusing ads and repetitive word-speak, to a finite number of specifications having some degree of precision in their common usage.

In the meantime, remember that anytime you're reading specs, try to determine whether the writer is talking in terms of

voltage (two times increase = 6dB) or wattage (two times increase = 3dB)...it can make a world of difference in what the real specification means. It isn't always easy to determine, nor is the reference dB that the writer might be using always the accepted standard, but most specs are referenced against: 1 milliwatt into 600 ohms for wattage (called a dBm) and 773 millivolts into 600 ohms for voltage (called a dBV). For true dB gain comparisons, the input and output impedances must also be equal.

See the sidebar chart for decibel (dB) ratios from zero dB to 100dB for both wattage and voltage. Notice the logarithmic rise in both, but differing for wattage and voltage.

The same ratios apply in the negative direction when calculating dB below zero. As an example: a +60dB increase in wattage would be a 1 million to 1 increase, a -60dB decrease in voltage would be a 1,000 to 1 decrease. 73

FYI: Please send 73 your filled-out Feedback card...73 Magazine values your input...(plus there's a drawing from the cards received for a free subscription too.) Tnx. Last month's winner: Phil Licwinko of PA.

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SPECIAL EVENTS

Listings are free of charge as space permits.Please send us your Special Events two months in advance of the issue you want it to appear in .For example, if you want it to appear in the April issue, we should receive it by January 31. Provide a clear, concise summary of the essential details about your special event.

MAY 26

WEST FRIENDSHIP, MD The Maryland FM Assn. will hold their Hamfest at Howard County Fairgrounds. Talk-in on 146.76, 224.76, and 444.00. Contact *Melvin Seyle WA3KZR, 15809 Pointer Ridge Dr., Bowie MD 20716. Tel. (301) 249-6147.*

MAY 31, JUN 1–2

ROCHESTER, NY The Rochester Hamfest and Computer Show, combined with the New York State Atlantic Div./ARRL Convention, will be held at Monroe County Fairgrounds, Route 15A. Schedule: Fri., May 31st: 6 AM Outdoor Flea Market. 6:30 PM: Annual Banquet. Sat., Jun. 1st: 8:30 AM–5:30 PM: Exhibit Hall Open. Sun., Jun. 2nd: 8:30 AM–1:30 PM: Exhibit Hall Open. 1 PM: Grand Award. The outdoor Flea Market runs continuously all weekend. Accommodations at the Rochester Marriott Thruway Inn, P.O. Box 20551, Rochester NY 14602; Tel. (716) 359-1800. You MUST tell them you are with the Rochester Hamfest. For accommodations at other hotels, airline tickets, car rentals, call the Hamfest official travel agency, Gallery of Travel, (800) 724-2046 or (716) 427-0920. There is no charge for the agency services. Talk-in Rptr.: 146.28/.88. Contact during business hours, *(716) 424-7184.* For ticket info, call *(716) 671-4430 before 9 PM. Internet: http://www.vivanet.com/-rochfst/hf/main96.html. Email: rochfst@vivanet.com.*

JUN 1

FRIENDSHIP, WI A Spring Hamfest will be hosted by the Adams County ARC, 8 AM–2 PM at Adams County Fairgrounds. Setup is at 7 AM. VE Exams. Tailgate selling area available. For details, contact *Adams County ARC, P.O. Box 232, Friendship WI 53934. Tel. (608) 564-7887; Packet: N9TD-1 on 145.03.* Talk-in on 145.29 Adams Rptr.

LOVELAND, CO The Northern Colorado ARC will sponsor "NCARC Superfest" at the Larimer County Fairgrounds, 700 S. Railroad, 8 AM–3 PM. Talk-in on 144.515/.115 PL 100; or 146.25/.85. For VE Exam and table info, call *Jeanene Gage NØYHY, (303) 351-7327.* For general info, call *Michael Robinson AAØUB at (970) 282-1167.*

SPRINGFIELD, IL A Hamfest sponsored by Sangamon Valley RC will be held at Illinois State Fairgrounds, 4-H building, 8 AM–1 PM. FLEA Market. VE Exams at 9 AM. Talk-in on 147.315, 224.68, and 444.75 (all -103.5 Hz tone). Contact *Don Pitchford WD9EBK, RR#1 Box 104, Springfield IL 62707. Tel. (217) 789-4519.*

TEANECK, NJ The Bergen ARA will hold its annual Spring Hamfest at Fairleigh Dickinson Univ. Flea Market, reservations required for power. The VE Exams contact is *Bob Neukomm, (201) 427-3568 before 10 PM.* Hamfest contact is *Jim Joyce, (201) 664-6727.*

JUN 2

CHELSEA, MI The Chelsea ARC, Inc., will hold their 19th annual Hamfest/Swap 'N Swap at Chelsea Fairgrounds, starting at 8 AM. Setup is at 6 AM. Talk-in on 146.980 Club Rptr. No VE Exams. For more info, contact *Alan Robbins, 3800 Hooker Rd., Pinckney MI 48169. Tel. (313) 878-0363.*

CONTOOCOOK, NH The Contoocook Valley RC will hold a Flea Market starting at 8 AM, Exit 7 off I-89, 14 mi. NW of Concord. Talk-in on 146.895(-) or 146.94(-), and 146.52 simplex. For details, call *John Moore N1FOJ, (603) 746-4817; or Packet BBS: WA1ALM @ WA1WOK.*

CORAOPOLIS, PA The 42nd annual Breezeshooters Hamfest and Computer Show will be held at the Butler Farm Show Grounds, 8 AM–4 PM. Table selection is on a first-come-first-served basis, so apply today. Contact *George Artnak N3FXW, 3350 Appel Rd., Bethel Park PA 15102. Tel. (412) 854-5593.* Indoor tables must be reserved before May 20th. Product demos by ICOM America. Mobile check-in until 2 PM: 28.495 and 146.520 MHz. Talk-in on 147.96/.36 W3UDX Rptr., courtesy the Butler County ARA.

FENTON, MI A Hamfest/Computer Fair will be held by the Fenton Area ARA, 8 AM–2 PM, at Ben Sherman M.S., 14470 N. Holly Rd., Holly MI. Sat. night setup. Talk-in on 146.78(-). Reg. for VE Exams at 9:30 AM; sessions start at 10 AM. Contact *Marty WD8RCI at (810) 634-9826; FAX (810) 634-0866.* Mailing address is *F.A.A.R.A. Hamfest Committee, P.O. Box 46, Fenton MI 48430.*

MANASSAS, VA The Ole Virginia Hams ARC, Inc. will hold the "Manassas Hamfest Amateur Radio and Computer Show" at Prince William County Fairgrounds, 1/2 mi. south of Manassas, on Rte. 234. Tailgate setup 2 PM till 11 PM on Sat. Food venders must obtain prior written approval from the Hamfest Chairman. Dealers, call *Joe K4FPT, (703) 368-5424.* For general info, call *Mary Lu KB4EFP, (703) 369-2877*

JUN 8

BYRON CENTER, MI The annual IRA Hamfestival will be held at the Hudsonville Fairgrounds near Grand Rapids MI. Doors open at 8 AM; setup is June 7th after 8 PM, or after 6 AM on the 8th. Overnight camping available. VE Exams. Book reservations early if you are interested in indoor table space. Contact *Tom KA8YSM,* or *Kathy KB8KZH, at (616) 698-6627,* or write the *IRA, 562 92nd St. SE, Byron Center MI 49315.* Talk-in on 147.16 link Rptr. system.

KITCHENER, ONTARIO, CANADA The 22nd annual Central Ontario AR Fleamarket will be held at Bingeman Park. This event will be jointly sponsored by Guelph ARC and Kitchener-Waterloo ARC, Inc. Talk-in on 146.97(-), or 145.21(-). Contact *Ted Eaton VE3GJE, 102-21 Woodlawn Rd. E., Guelph Ont., Canada N1H 1G6. Tel. (519) 823-1027;Packet: VE3GJE@VA3RWP.#SWON.ON.CA.NA. Internet:eeaton@sentex.net.*

RIVERDALE, NJ The annual North Jersey Hamfest, sponsored by Split Rock/West Morris Radio Clubs, will be held at the NJ Nat'l. Guard Armory on Newark Pompton Tpk. (Rte. 23). Talk-in on 146.985/.385 or 223.860/222.260 PL 136.50. Contact *Bernie WB2YOK, FAX/Voice (201) 584-5399* any time; or *75503,3221@COMPUSERVE.COM.*

WINSTON-SALEM, NC The Forsyth ARC will host the Winston-Salem Hamfest, Computer and Electronics Fair at the Dixie Classic Fairgrounds beginning at 8 AM. Free camping Fri. night. RV hook ups available for a nominal fee. Open and covered tailgating. Dealer tables. Flea Market tables. ARRL VE Exams. Talk-in will be on the 146.64(-) Rptr. Visit our website at *http://www.rbdc.com/~kq4lo/farc.htm.* Contact *Forsyth ARC, Inc., P.O. Box 11361, Winston-Salem NC 27116. Tel. (910) 723-7388. FAX: (910) 765-6656.*

JUN 8–9

ATLANTA, GA The 1996 Atlanta Hamfestival and ARRL Georgia State Convention will be held at City Hall East - Exhibition Center, 675 Ponce de Leon Ave. (across from Crackers' Ponce de Leon Park). Talk-in: W4DOC on 2 meters at 146.82. An Atlanta Police officer will provide on-site security for the nights of June 7th and 8th. Flea Market: Ham Gear, Computers, Electronics, Software, Parts, etc. VE Exams. Ladies Activities, and much more. For more details, see our display advertisement in this issue. Show hours: Sat. 9 AM–4 PM; Sun. 9 AM–3 PM. Contact Hamfest Chairman, Marty AA4RM, (404) 814-9304. For Commercial Booths, call Bill W4LFC at (770) 493-8438. You can find Hamfest info on the BBS at (770) 850-0546. Internet address: marty@aa4rm.radio.org.

JUN 9

COVINGTON, KY The Northern Kentucky ARC will hold "Ham-O-Rama '96" at the Erlanger Lions' Park. Indoor exhibit area. Outside Flea Market with setup at 6 AM. General admission begins at 8 AM. Provide your own tables. Contact *N8JMV, c/o NKARC, P.O. Box 1062, Covington KY 41012; or call (513) 797-7252 eves.* Talk-in on 147.255(+) or 147.375(+) Rptrs.

GRANITE CITY, IL The Egyptian Radio Club annual Egyptian Fest/Hamfest, Computer Fair and Flea Market will be held at the Granite City Campus of Belleville Area College, 1/2 mile south of I-270 on Maryville Rd., 8 AM–1 PM. VE Exams. Indoor Dealer and Exhibit area. Talk-in on 146.79. Contact

Egyptian Radio Club, P.O. Box 562, Granite City, IL 62040; or call *Bill Dusenbery N9OQK, (618) 398-1456.*

MANCHESTER, MD The Hanover Area Hamming Assn. will present the Pleasant Hill Ham and Computer Show at Pleasant Hill Fire Co., 5 mi south of Hanover, on Rte. 94. The event starts at 8 AM. Talk-in on 146.895(-). VE Exams at 9:30 AM; contact *Bill NZ3J, (717) 359-7090,* or *Pat WW3U, (717) 632-4237.* Please pre-reg.

QUEENS, NY The Hall of Science ARC Hamfest will be held at the New York Hall of Science parking lot, Flushing Meadow Park, 47-01 111th St. Setup at 7:30 AM, buyers admitted at 9 AM. Talk-in on 444.200 WB2ZZO Rptr, 146.52 simplex. For info call *Arnie Schiffman WB2YXB, (718) 343-0172, eves.*

JUN 14–15

ALBANY, GA The 14th annual Albany ARC Hamfest and Georgia Computer Fair, (1995 ARRL Georgia Section Convention), will be held at the James H. Gray Civic Center, Oglethorpe Dr. (Hwy. 82) at the Flint River, Albany GA. Table fees include passes for workers. Pre-reg. before June 1st. VE Exams $6.05 per person (checks only, no cash accepted). Rooms for conducting radio and computer forums are free. No alcoholic beverages allowed. No "Adult Entertainment" type of materials allowed. Contact *William A. Shipley, (912) 439-2351 Ext. 15.* Mail payments to *Albany Amateur Radio Club, Inc., P.O. Box 70601, Albany GA 31708-0601.*

JUN 14–16

RED DEER, ALBERTA, CANADA The Central Alberta Radio League will host its 26th annual Picnic and Hamfest at the Burbank Campsite (about 8 km NE of Red Deer). There will be many activities and displays. Contact *Bob VE6BLD, 5540 54th Ave., Lacombe, Alberta, T4L 1L6. Tel. (403) 782-3438. Packet VE6BLD @ VE6RDR.AB.CAN.*

JUN 15

BLUEFIELD, VA Bluefield Hamfest, Inc. will sponsor the Bluefield Hamfest and Computer Fair, 9 AM–3 PM, at the Graham M.S. VE Exams at 9 AM at the Hamfest site. Walk ins accepted. Talk-in on 145.49 (BR549) Rptr. For more info, send SASE to *Bluefield Hamfest, Inc., 412 Ridgeway Dr., Bluefield VA 24605-1630;* or call *Don Williams WA4K, (540) 326-3338.*

DUNELLEN, NJ Raritan Valley Radio Club will present its "96 Hamfest" at Columbia Park near the intersection of Rte. 529 and 28, 7 AM–2 PM. Talk-in on 146.625(r)/.520(s)I. For details, contact *John Manna WA2F at (908) 722-9045;* or *Bob Pearson WB2CVL, (908) 846-2056.* To pre-reg., call *Guy Glaser (908) 968-0297* (all before 8 PM).

JUN 16

DYER, IN The Lake County AR Club will hold their 24th annual Dad's Day Hamfest at the Lake County Fairgrounds in Crown Point IN. Doors open at 6 AM for vendors and 8 AM for the public. VE Exams at 9 AM. Talk-in will be on 147.000(+). Contact *Dave Snell N9WLP, 833 Schilling Dr., Dyer IN 46311. Tel. (219) 865-6131.*

MONROE, MI The Monroe County Radio Comm. Assn. will host the Monroe Hamfest at Monroe County Fairgrounds, M-50 at Raisinville Rd. Please contact *Fred VanDaele, 4 Carl Dr., Monroe MI 48162. Tel. (313) 242-9487.*

JUN 20

RICHMOND, IN A Fly-in, Drive-in Hamfest/Computer Show will be held 8 AM–3 PM at Richmond Municipal Airport. Setup 3 PM–5 PM June 29th and 6 AM–8 AM June 30th. Commercial vendors and Flea Market. Talk-in on 147.270/.870. Contact *Ken KB9VO* or *Janet KB9UP, 3425 Woods Dr., Richmond IN 47374. Tel. (317) 935-2853.*

JUN 28–30

RAPID CITY, SD The Black Hills ARC will host a Hamfest at Surbeck Center on the campus of SD School of Mines & Tech., 501 E. St. Joseph St. Flea Market. AR equip. vendors. VE Exams. QCWA Meeting. Forums. Pre-reg. is $8 before June 1, via *P.O. 294, Rapid City SD 57709.* Include SASE for confirmation and details.

JUN 30

WHEATON, IL The Six Meter Club of Chicago, Inc. will present their 39th annual Hamfest at the DuPage County Fairgrounds, 2015 Manchester Rd. Gates open at 7 AM. General parking at West Gate; Sellers only at East Gate. Talk-in on K9ONA 146.52; K9ONA/R 146.37/.97 (107.2). No alcoholic beverages permitted. For info, call the 24-hour InfoLine: (708) 442-4961. Make checks payable to Six Meter Club of Chicago, and SASE to *Six Meter Club of Chicago, 7109 Blackburn Ave., Downers Grove IL 60516,* no later than June 10th.

JUL 6

SALISBURY, NC The North Carolina Alligators Group will hold their Firecracker Hamfest at Salisbury Civic Center, 8 AM–1 PM. Setup at 7 AM Sat., or 3 PM–9 PM Fri. Talk-in on 146.730. Contact *Walter Bastow N4KVF, 3045 High Rock Rd., Gold Hill NC 28071. Tel. (704) 279-3391.*

SPECIAL EVENT STATIONS

MAY 27

ALTON, IL The Lewis and Clark Radio Club will operate KG9DD 1400 UTC–2000 UTC in commemoration of the Alton Memorial Day parade, which has been held every year since 1869. Freq.: 7.265, 14.265, 21.375, 28.400. For a certificate, send name, address and QSL to *Dennis Tuchalski N9WDQ, 2300 Morning Star Dr., Alton IL 62002-5623 USA.*

JUN 1

LA GRANGE PARK, IL The Six Meter Club of Chicago, Inc. will operate K9ONA from 1400 UTC–2200 UTC to commemorate the 50th Anniversary of the La Grange IL Pet Parade. Look for K9ONA on the lower portions of the General phone sub-bands, 40 through 10 meters, and on the 146.37/.97 K9ONA Rptr. (107.2 Hz). A special QSL card will be available for an SASE to *Karl Weisshappel WA9CCQ; 820 Barnsdale Rd., La Grange Park IL 60526 USA.*

MT. CARMEL, IL The Radio Amateur Downstate Illinois Org. will operate club station WD9GTW, 1500 UTC–2200 UTC at the Mt. Carmel Airport Appreciation Days. Operation will be on the General phone subbands on 15, 20, and 40m; 28490 on 10m; and 146.940 Mt. Carmel Rptr. For a certificate, send SASE with QSL to *R.A.D.I.O., 827 Broadmoor, Mt. Carmel IL 62863 USA.* For info call *(618) 262-7111.*

NEW PORT RICHEY, FL The Pasco County RACES will operate Station KD4TLQ during the 2nd annual Hurricane Expo. Operation will be on the lower portion of the General band of the 20, 40 meter phone subband 1400Z–1900Z. For a certificate, please send a QSL and SASE to *Pasco County Office of Disaster Preparedness, 7530 Little Rd., Emergency Communications Center, New Port Richey FL 34654.*

MANCHESTER, NH THE Amoskeag RC will operate Station KB1BQK 1200 UTC2000 UTC, in celebration of the Manchester NH Sesquicentennial. The Station will be operated at Derryfield Park. Freq.: near 20m/14.245, 15m/21.045, 40m/7.245, 40m/7.035 CW. QSLs upon contact and request to *Amoskeag Radio Club, P.O. Box 996, Manchester NH 03105 USA. Contact person: Al Stewart N1SMB, (603) 622-4712, or NONESMB@AOL.COM.*

JUN 8–9

FULTON, NY The Oswego County Amateur Radio Emergency Service, ARES, will operate KY2F June 8th and 9th, 1200Z–2000Z each day during the Experimental Aircraft Assn's Young Eagles Days. The Oswego county Airport is the location for this event. Operation will be in the lower half of the General 80, 40, 20, 15 and 10 meter phone bands. for a certificate, send your QSL card and a large SASE to *Fred Swiatlowski KY2F, P.O. Box 5281, Oswego NY 13126 USA.*

JUN 15–16

DAYTON, OH Station KB8JUA will operate in celebration of Dayton's bicentennial. Operation will be 1500Z–2200Z. CW–7.125, 14.125, 21.125, 28.125. Phone–7.275, 14.275, 21.375, 28.475. For a certificate, send a 9x12 SASE to *Mike Priest KB8JUA, 626 Creighton Ave., Dayton OH 45410 USA.*

DEARBORN, MI The Garden City ARC will operate KC8BEB 1400Z–2000Z June 15th and 16th to commemorate the American Automobile Centennial, from the Henry Ford Museum and Greenfield Village. Freq.: 7.255, 14.255, 21.330, and 28.380. For a certificate, send a #10 SASE to *G.C.A.R.C., P.O. Box 482, Garden City MI 48135 USA.*

JUN 22–23

SONOMA, CA The Valley of the Moon ARC will operate Station WB6DWY during Field Day from 1500 UTC on the 22nd–0400 UTC on the 23rd. The event will celebrate the Sonoma sesquicentennial festivities, marking the 150th Anniversary of the Bear Flag Revolt, which led to California's independence from Mexico. Freq.: (+/-) 7.250, 14.250 and 21.350 MHZ SSB. A commemorative QSL card will be offered to all stations confirming contact during the event with a QSL card. QSL to *WB6DWY, 358 Patten St., Sonoma CA 95476.* For more info, contact *Darrel Jones WB6BOR at (707) 996-4494.*

JUN 8

JUN 29

CHITTENANGO, NY The Madison/Oneida ARC will operate Station KB2UDX 0900–1730 EDT at the Chittenango Landing Canal Boat Museum, in celebration of the museum's Canal Festival Day. Operation is planned for the General portions of 75, 40 and 20 meter phone, and the Novice SSB subband of 10 meters. For a certificate, send QSL and SASE to *MOARC, Box 241, Verona NY 13478 USA.*

JUL 1

THORNHILL, ONTARIO, CANADA The Thornhill RAC will operate VC3D in conjunction with the City of Vaughan, Ontario, to celebrate Canada Day 1996. The station will be on the air during the RAC Canada Day Contest. To encourage the participation of other clubs, the Thornhill RAC will issue a certificate to acknowledge the contact during the contest. QSL cards will be available to all other contacts .For a club certificate or QSL card, send an SASE and your QSL card to *VE3YQY, c/o Gord Yazer, 24 Lindemann St., Thornhill Ont. L3T 5M8.*

JUL 12–14

PORTAGE DES SIOUX, MO The St. Charles County ARES will operate NØPNP from 0200Z Jul. 12th 1700Z Jul. 14th, as an ARES emergency exercise. Operation will be on phone near the top edge of the 80 meter–10 meter General class subbands, and near 28.350 MHz in the Novice class portion of the 10 meter voice subband. Local operation and Talk-in will be on the 145.49(-) ARES Rptr. For a QSL, send a letter-size SASE to *St. Charles County Emergency Management Agency, 301 Second St., St. Charles MO 63301.* The exercise will be operated from the shore of the Mississippi River. a brief history of the area will be included with the QSL on request.

JUL 20

BERGEN, NY The 1st annual Wire Antler Contest will be in two parts. (1) Build a 10m antenna using only wire and rope. Max. length not to exceed 140 ft. (2) The operating phase will be a Sprint-style operation 1900 GMT–2300 GMT on 10m SSB, from 28.300–28.500 MHz. Logs shall be postmarked no later than 31 Aug. 1996. Send packet inquiries to *Keith KE2DI [KE2DI@WB2VPH.#WNY.NY.USA.NOAM]* or *John KF2XC [KF2XC@WB2WXQ.#WNY.NY.USA.NOAM].* NOTE: No logs will be accepted via Packet! 73

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Send your ads and payment to: *73 Magazine*, Barter 'n' Buy, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls. The deadline for the July 1996 classified ad section is June 12, 1996.

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WANTED: QSL Information from Phila Holmesburg Amateur Radio Club. Also wanted is information on the 15m Planetarium CW Net and for the following call signs: KA3IZF, AA3AW, SSV, KT4K, N2SFT, KW1C, PC5PKHT, KA1TQK, NA1TQK, K4CRF, KC4QMX, K4IVK, AA9JM, K4FLA, K8MTH, KC8BTE, KC5IWN, WYFR31M, K3EQ, AC4TYA, WA2PJF, K5TF, K4DX, WB4FFJ, K6CR, VE1TRH, CO3JY, W1CW, WZNUV, W8US, W9FF, W8AW/HCJB, W4AX, VCS, WCC, KA3LVN. **Phone** (215) 877-2665.

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QSL Contest

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Send it to: QSL Contest,
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Above & Beyond

VHF and Above Operation

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More Test Equipment for the Microwave Workbench

Last month I covered frequency counters and recommended some basic microwave essentials for the test workbench. This month I will expand on that idea, covering some other handy gadgets that make microwave life on the workbench more enjoyable. I have also bundled together several technical tips, including one from the North Texas Microwave Group giving recommendations on how to test GaAsFETs with a VOM. In this application Kent WA5VJB describes how to test GaAsFETs to see if they're still alive, without destroying them.

Last month I discussed the use of a Gunn diode and attenuator (**Photo A**) to provide 10 GHz frequency drive for alignment and test generation. What about other frequencies? Is the Gunn diode arrangement still viable? Well, the answer can be "yes," but most likely it's "no." It still depends on what frequency you use and what you can find at an attractive price to pull the signal generation at your desired frequency. For 10 GHz operation the Gunn generator is fantastic; for lower frequencies something else is needed.

The oscillator

The oscillator you select for other frequency operation doesn't have to be anything as exotic as a frequency synthesizer. One of those would be nice, but anything from a crystal-controlled multiplier string to a free-running oscillator at the frequency of interest would function just fine. Be aware of your surroundings and try to adapt something that you can find locally for minimal cash outlay. As amateurs, we are known as good scroungers.

***Photo A.** A signal marker for 10 GHz use driven by a 2 meter HT. It produces a calibrated harmonic in the 10 GHz band for calibration purposes.*

If you are lucky enough to have a wide-range sweep oscillator that tunes from 1 MHz to 18 GHz in one unit, you just might want to skip this message and go read the sports page. If you're still here, let's see what you can try to locate to pull this project together from whatever surplus is available locally. What would be very good to look for is some means of obtaining frequency agility so you can test several bands using one simple device.

To my knowledge, the most economical versatile oscillator in easy-to-obtain material is the CATV or TV tuner front end. These can be picked up from your local TV repair shop or similar facility at little or no cost. They all contain a VCO in the several hundred to 1000 MHz or so frequency range, are inexpensive (notice I did not say cheap), and provide a hefty local oscillator signal output capable of injection directly into a mixer.

I might be over-pounding my drum on scrounging used or near-new TV/CATV components. But heck, it works and the parts are easily found in scrap or in the back of almost any agreeable TV repair shop for little or nothing. If you blow up (destroy the tuner) during conversion, go pick up several more. This is not a hard object to play with. Sure, it might take a little tinkering to figure out what lead provides what voltage and control but if they can be picked up for next to nothing, what's the gamble?

The tuner will be OK for frequencies up to 1 GHz. For testing on frequencies from 902 MHz and lower, it should be very suitable. For 1296 MHz and above, you will have to build other circuitry.

Typically, an MMIC (Microwave Miniature Integrated Circuit) type amplifier is driven hard into saturation to produce nonlinear operation. This causes the amplifier to be rich in harmonic output, due to operation in the non-linear region of its curve. Overdriving an MMIC amp input is the easiest way to cause this effect. The circuit for an overdriven MMIC is the same as a conventional MMIC amp circuit; it's just that you overdrive the circuit on its input. This scheme will give you good harmonic marker generation.

"The most economical versatile oscillator available in easy-to-obtain material is the CATV or TV tuner front end."

Another way to generate frequencies above 1 GHz (1000 MHz), like 1296, is to use mixed products of two generators. For example, connect the TV oscillator to a mixer with another lower frequency test generator and regenerate a signal that is a product of the two generators. I tried to generate 1296 by selecting a TV oscillator at 900 MHz and combining a bench signal generator (HP-608) tuned to 396 MHz, producing 1296 on the RF port of the mixer as one of the products. This scheme works well for frequencies in the 450 MHz to 1296 MHz range, where signal generation can be a little hard to locate.

The mixer requires the capability for operation at your RF frequency. For frequencies up to 2000 MHz a Mini Circuits SRA-11 can be used at powers of +10 dBm, with oscillator levels in the +7 dBm range. There are many different types of mixers suitable for this operation that could have coaxial type connectors mounted as part of the mixer assembly.

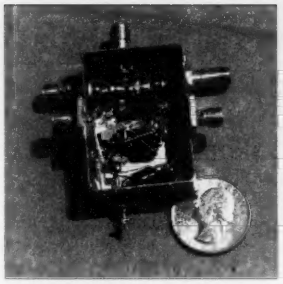

***Photo B.** Utility mixer for 10 GHz. The principles explained in the text can be applied to any other frequency by proper scaling of model. This circuit is actually a GaAsFET amplifier that is modified to be a mixer. See text for construction details.*

The principles used in the signal generator circuit were tried many years ago when we were using WBFM simple receivers and did not have a good microwave signal generator to test them. What we did was take a microwave Gunn oscillator and use it as a local oscillator injected into the LO port of a microwave mixer. The IF port was similarly injected with a low frequency signal generator capable of operating from 10 MHz to 500 MHz. The RF port of the mixer carried the resulting products – that is, the Gunn frequency plus and minus the low frequency RF generator's frequency.

By setting the low frequency generator to, let's say, 200 MHz and adjusting the Gunn oscillator for a proper mix as detected on the receiver being tested, we were able to control the low frequency generator's frequency and level and make performance tests at 10 GHz. It's not highly calibrated in microvolt sensitivity but it does give some very meaningful evaluations of your system's performance.

Frequencies in the range of 3456 MHz and above require somewhat more complex circuitry. For 2304 operation our microwave group was lucky enough to have a supply of synthesizers, to use for local oscillator generation or test units. Normally, surplus oscillators for this range are scarce because there aren't many available. We seem

to be blessed in having two types to choose from: a Dielectric Resonator Oscillator (DRO) and a Voltage Controlled Oscillator (VCO). Both devices operate similarly, but the VCO is much more flexible than the DRO. The primary advantage to the VCO synthesizer is that it is more frequency-agile and has lower phase noise even after a multiplication of times four.

If you can't locate devices for the CATV tuner or the DRO or VCO synthesizers, I can supply any of these items for a minimal cost. The CATV tuners (new surplus) are $10 each postpaid or three for $20 postpaid. The DRO oscillators are $15 each, and the VCO synthesizers are $35 each postpaid for U. S. destinations. Both the DRO and VCO synthesizers require modifications before they can be put to practical work. If you are looking for a simple unit to experiment with, get the DRO unit. So much for oscillators.

The octopus mixer circuit

This octopus mixer is, in reality, an amplifier with added ports, allowing other frequency signals to be connected to and extracted from it. **Photo B** shows a beta test mixer. It might look a little strange with all the other coax connectors tied into the system. Basically, this unit is a 10 GHz amplifier of the single-stage variety and uses a single Mitsubishi MGF-1402 FET. Its design is straightforward: The amp input and output are isolated with 1 pF chip capacitors, and the FET is connected to input and output striplines. DC bias voltages are fed to this stripline via narrow-trace printed copper traces which act as RFCs to the 10 GHz signal. These traces (RFCs) carry the input negative bias and output DC voltage for operation of the amplifier.

"The octopus mixer is an amplifier with added ports, allowing other frequency signals to be connected to and extracted from it."

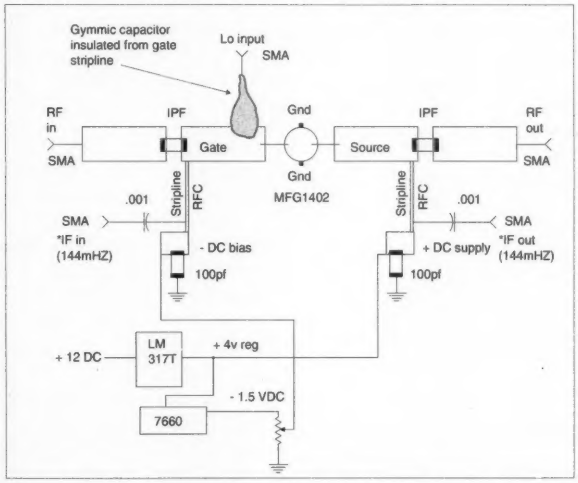

Fig. 1. Utility 10 GHz amplifier converted to a mixer configuration with additional input/output ports added. Concept is usable at other RF frequencies by adjusting size and component values, as shown in table.

RF In	IF In	IF Out	Lo In	RF Out
10.368 GHz	Ø	Ø	Ø	10.368 GHz
10.224 GHz	144 MHz	Ø	Ø	10.224 GHz
10.368 GHz	Ø	144 MHz	10.224 GHz	not used
Ø	144 MHz	Ø	10.224 GHz	10.368 GHz 10.080 GHz

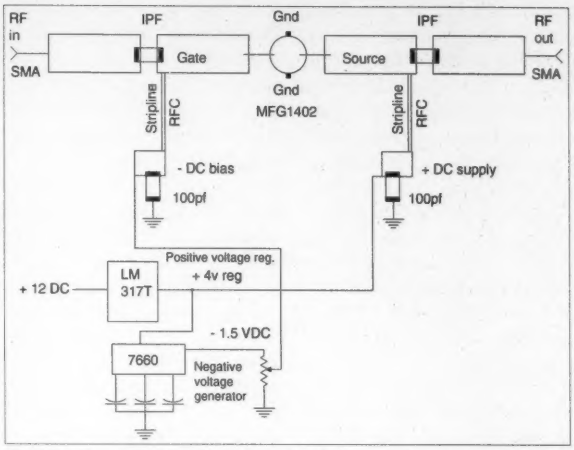

Fig. 2. Normalized schematic of basic amplifier circuit used for mixer construction as in Fig. 1.

The circuitry below the FET amplifier is the positive and negative DC bias circuitry which allows the amplifier power supply to be self-contained and fed with only a single DC power input. See **Fig. 1** for the basic mixer amplifier circuitry, and **Fig. 2** for the normalized schematic of the 10 GHz amplifier before modification. The connections used in the modifications can be made applicable to any other frequency by proper scaling of the components/materials.

The mixer was equipped with many connectors to test the viability of using the amplifier as a bidirectional mixer; at the input side we could combine both an SHF and a VHF signal and have the product available on the normal output at SHF. Also, we could combine two SHF signals on the input to down-mix, setting the RF pickoff on the output to VHF by picking off RF from the RFC circuit. In this case, we would not use the normal RF output port.

Use good static prevention, namely a grounded work station. This could be anything as simple as a small chunk of copper PC board material to which everything is common grounded. That means you (wearing a static wrist strap), your low voltage soldering iron, and the amplifier to be modified. Everything is tied to the same sheet of copper, which is tied to a firm ground. (Please note: Your wrist strap contains a high resistance protection for your safety. You are not connected directly to ground. The high resistance provides a measure of protection in case the circuit accidentally connects to a foreign high voltage or AC. The wrist strap's purpose is to bleed off static charges, not pass power.)

The amplifier modification is carried out by first attaching extra connectors to the case so that you can connect input and output probes to the amplifier. If the amplifier you modify is lower in frequency it will be easier, as the size of the circuitry increases as frequency is lowered. Position the connectors in a similar fashion and experiment with the positioning of connections.

The marker generator

Another adjunct that can be very useful with microwave operation is a marker generator, which allows you to calibrate the operational frequency. This is especially useful if the equipment being used is simple wideband FM Gunn-type transceivers. These WBFM transceivers are not very stable, but they do provide an entry method into the microwave communications world for little expense.

The marker is nothing new and is not difficult to construct. It is made by obtaining a waveguide detector mount with a 1N23-type diode and driving this diode with RF power (100 mW) on a frequency of 146 MHz. The diode

rectifies and acts like a varactor, producing harmonics of the fundamental frequency. In this case, the driving power is a 2 meter HT on low power (FM) and the waveguide structure kind of supports the harmonics in the 10 GHz range. Now locating a frequency with an uncertainty of 146 MHz error is no problem at all. You don't have to worry about being off frequency by that much with simple equipment. This is not to say it couldn't happen, but it is unlikely.

Why use exactly 146 MHz for this test? Well, the 70th harmonic of 146 MHz is exactly 10220 MHz. This frequency is one of the main WBFM frequencies targeted for WBFM (Wide Band FM) operation. The other frequencies are 10250 and 10280 MHz. Notice that they are separated from each other by 30 MHz. This is due to the simple structure of the transceivers, which use each other's local oscillator to mix in the detector diode receiver and produce a 30 MHz offset of IF amplifier signal.

The harmonic calibrator can be improved greatly by replacing the 1N23-type diode with a varactor which is much more efficient in generating harmonics than the 1N23 detector. Don't forget to provide a ground return for the diode, using an attenuator between the transmitter and the diode. Most 2 meter transmitters have a 100 mW low power option switch, which in dB is +20 dB. All that is required is +10 dB, so a 5 to 10 dB pad (attenuator) needs to be connected coaxially between the antenna of the HT and the detector mount.

The RF sniffer circuit

The next handy item in the RF arsenal of tools on the bench is an RF sniffer circuit. It's basically a 50 ohm load sampled by a diode detector and tied to a sensitive meter. Use a meter amplifier for higher sensitivity. This can be nothing more than a terminated coax connector sampled by a diode detector then bypassed and fed to a low current microamp meter. If you connect a short antenna to the input connector it will serve as a (relative) field strength meter, and by making direct connection to the coax connector it will serve as a relative low power meter. This power meter can be used to tune up small oscillator strings or other RF low power output circuits, taking the place of commercial microwave power meters. The calibration and frequency response is always subject to construction differences and materials used. However, it can still be a good set of eyes up to 2 GHz or so for an indicator until you can actually calibrate it. Even if not calibrated, it will show you tuning adjustment indications.

You don't have to go through that exercise if you have a mixer available for your conversion. It is nice to know that there is some other method that can produce the same results, and even provide some extra gain in the process. Don't be embarrassed to try a new idea just because someone says it can't be done. If you haven't got anything to lose, give it a shot. You might come up with some new and enlightening idea. Be inventive; use the junk box and take a look at some of the circuitry that exists there —it can save you a lot of bucks.

As always, I will be glad to answer questions pertaining to this and other amateur-related topics. Please send an SASE or drop me a line on the Internet (clhough@aol.com). 73 Chuck WB6IGP 73

Ask Kaboom

Your Tech Answer Man

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Peterborough NH 03458

Sweating the small stuff

If you've been working on radio, audio, video or computer gear at all for the last few years, you've undoubtedly noticed that your eyes were going bad and you were getting clumsier. Wait a minute, it isn't you; the circuitry is getting smaller and smaller, almost to the point of absurdity! Let's face it, we've all come to expect two-pound camcorders, CD players barely bigger than the discs they play, and high-powered Pentium and PowerMac computers we can plop into our briefcases.

Ham radio has gone the same way, especially in the walkie category. Just a few years ago, the ICOM IC-2AT was the standard 2 meter handheld. When it came out, the radio seemed a marvel of miniature engineering. Heck, you could hold it in one hand with no trouble at all. Many of these radios are still in use today, but they look positively huge, as do all the handhelds of that time. Even the Kenwood TH-21AT, the smallest HT of its day, doesn't look so darned small anymore. Our concept of small sure has changed! Although HF radios have until recently resisted the "small is beautiful" concept, they too are beginning to yield, with new 100-watt HF rigs no larger than the 2 meter mobiles of four or five years ago.

SMT/SMD

If you want to fit a dual-band HT with 50 memories, CTCSS encode/decode, digitally coded squelch, and all the rest of the goodies into a 2" x 3" x 1" box, you just can't wire it up on an old-fashioned, single-sided PC board, using regular parts and hand soldering. Nobody has hands that small or vision that good.

To get our gadgets to the size scale we have now, manufacturers had to invent a whole new way of making things. There were two keys to miniaturization: the integrated circuit, or IC, and SMT, or "surface-mount technology." The actual parts used in SMT are called, naturally enough, "surface-mount devices," or SMDs. Quite often, you'll see the terms SMT and SMD used interchangeably.

SMT made things smaller for several reasons. First, the parts didn't have wires sticking out, so they didn't need places on the components to mount them. Second, because they were mounted on the surfaces of PC boards, no holes had to be drilled through the boards, so designers could run other conductors behind the parts, either on the other side of the boards or *inside* them! Inside? Yup, I'm afraid so. Many of the mini wonders we so covet are made with triple- and even quadruple-layer boards. Of course, it's possible to make such boards for use with lead-mounted parts, but it's much harder, because the internal traces have to be routed around all those holes. With SMT, it's clear sailing all the way.

But how?

Although early surface-mount parts weren't much smaller than their lead-mounted predecessors, the parts quickly began to shrink. Even the larger ones were pretty hard to hand-mount, but today's "grain of salt" resistors can hardly be seen, let alone placed by hand.

Robotics provided the answer. A robot could operate with much greater precision than could a human, and it wouldn't get tired and start making mistakes, either! Pretty soon, robots were building most of the boards in our toys. In many cases, manufacturers consider these boards unrepairable; if it stops working, the board is replaced.

Can I fix it?

That leaves us hams in an odd predicament; we want tiny radios, but they're very hard to work on,

and fixing our own gear is supposed to be part of this technical hobby. Many hams are intimidated by SMT, and with good reason. Can you successfully repair or modify a radio made from SMDs? Yes, but I say that with some reservations. For many people, the size scale of modern radios is just too small. Let's take a look at working with surface-mount devices.

First of all, you'll need some new tools. You just can't tackle a micro-miniature radio with a 100-watt soldering gun! Even your trusty 30-watt pencil with its 3-millimeter tip is way too big. For SMD work, you need a 1 mm or smaller tip and about 15 watts of heat. Radio Shack™ has SMD tips for some of their guns, but you have to special-order them. Also, you need some very fine solder and narrow desoldering braid. Don't skimp and omit the braid; it's a crucial tool for this kind of work.

Even if you have good eyes, you will need some magnification to work at this size scale (besides, if you don't use a magnifier, you won't have good eyes for long). A head-mounted magnifier is extremely helpful. Also, get one of those little pocket-sized telescope/microscope combinations, if you can still find one. An alternative is a pocket microscope intended for the examination of phonograph styli (remember those?).

Very small screwdrivers are a must here. Trimpots and trimcaps are tiny now too, and you can't adjust them with normal-sized tools. A jeweler's screwdriver set is very useful.

Getting started

Although SMT boards are built with a special, low-temperature solder, you can use regular solder on them, as long as you're careful not to keep the iron on the board long enough to damage the traces. In keeping with the size of the parts, many conductors on these boards are ridiculously small, and they'll peel up if they get too hot, ruining the board. It's darned near impossible to fix it once that happens, especially if the board is multi-layered.

So, all soldering to a surface-mount board should be done very quickly and carefully. Of course, you don't want to make a cold connection, so you do have to keep some heat on the board for a few seconds. But, the old days of slathering on the solder until you have a big blob are over (not, of course, that anyone should ever have done that, but I've seen plenty of it). If you need to desolder, though, you may need your old 30-watt iron (but not the gun!). There's a great danger in trying to desolder without enough heat, in that you can pull traces up when you pull the braid away, because it gets soldered to them. The end result is just as bad as if you'd overheated them.

Although SMDs seem to take a surprising amount of heat without self-destructing, they are so small that the heat quickly makes it to the opposite connection, leaving you with a moving part when you didn't expect it. It can be mighty hard to get the part back where it was. A small screwdriver to hold it down can save the situation. If you get an SMD too hot for too long, the metal ends which provide the connections can dissolve, leaving you with a useless part. I've seen that happen more than once.

"We want tiny radios, but they're very hard to work on, and fixing our gear is supposed to be part of this technical hobby."

But what is it?

Now that we've looked at soldering SMDs, it might pay to know what it is we're soldering! Unlike good ol' "regular" parts, most SMDs have no markings on them; there just isn't room for any numbers. Some of the larger resistors have Japanese-style metric markings, like "103" for 10k ohms (that's a one, a zero and three more zeros), but don't be surprised to see tons (OK, milligrams) of unmarked parts. Here's a clue, though, as to how to identify at least some of them: The black ones are usually resistors, and the tan and green ones are capacitors. Polarized electrolytic caps are generally a bit bigger than resistors, and there will be a polarity marking on the parts. You may see some obvious resistors, with round bodies and color codes, but those are old parts; the latest stuff is all tiny, square and flat. Trimpots and trimcaps still look like they always did, only much smaller. Be careful turning them, because they can't handle much oomph. Transistors have two "leads" (stumps, really) on one side, and a third on the other. The single one is usually the collector.

Beyond these general guidelines, there really isn't that much different about SMDs. Some of the ICs, with their 64 or more leads, can be darned near impossible to change. It's rare, though, that you might need to do that. SMT is very reliable, with the most common problem being bad connections, particularly to the leads of ICs. I've seen many cold connections cause trouble. The hard part is soldering the leads without causing massive solder bridges, even if you were good at soldering standard components. If you must solder leads on one of those "millipede" ICs, try not to solder very close to the chip's plastic casing, because solder can get underneath, and it's mighty hard to remove it. If you do make some bridges (which I guarantee you will), use the desoldering braid across the entire bridge at once. Usually, that'll leave you with nice connections but no bridges. For that, you may need to use your bigger iron (but not the gun!).

Not for beginners

If you're new to electronics work, I recommend you stay away from SMDs until you're more experienced with normal, leaded parts. Even for old hands, this new technology is presenting challenges, especially as the parts get smaller and smaller. I was pretty good with the earlier SMDs, but the new ones are starting to reach my limits. If they get any smaller, I doubt I'll be able to work on them.

'Til next time, 73 de KB1UM. 73

Number 83 on your Feedback card

UPDATES

Can't seem to get those ducks in a row...

In Sam Ulbing N4UAU's "Tiny Tic-Tac Tester" article, *73*, March 1996, regarding the component values for battery chart—all columns should have lined up: Alkaline cells numbers should have been placed directly below the numbers for NiCad cells. It seems we missed something in making that chart.

Translation bollix?

In the April "Carr's Corner," in the second column on page 60 the values 50W, 5,000W, and 600W appear. These W (watt) values should all be Ω (ohms). In the original manuscript, they were correct, but for some reason, the Ω symbols all metamorphosed into Ws. The "200 watts" in the paragraph that follows is correct.

Also in April's issue, we began "Debunking Some Myths about Antennas, Feedlines & SWR" on page 40 and promised to continue it on page 59. **Toon 2** in the bottom right hand corner of page 59 is the second part of that article which is again continued on page 81.

Also on page 59, the two columns of "A Simple One–Hour" that claims to have been continued from page 40 should not be there. It is actually the specter of an article published months ago.

Author's update

Here's a tip from Marty Gammel KAØNAN for those of you who are having trouble finding the 3/16" copper tubing described in April's "440 Super J–Pole" article, and also May's "220 Super J–Pole" article. Go to the electrical department of your local building supply and ask for some #6 solid copper ground wire. The diameter is quite close to 3/16", and it works well as a substitute. It also bends more easily. (Its price should be about the same as the tubing.) 73

Coaxial Cable

Get comfortable with it.

George Wilson W10LP
82 Fraiser Way
Marstons Mills 02648

Of the many different types of coaxial (coax) cable, only a few are used by the average radio amateur. These have 1/4" and 1/2" "nominal" diameters. The 1/4" types vary from 0.195" to 0.262" in diameter and require different adapters when used with UHF and BNC connectors. The popular 1/2" cables are 0.405" in diameter. A 1/10" (0.100") diameter type is also popular. It's used for filters and resonant lines, most often within project enclosures.

Both 1/4" and 1/2" types are available in nominal 50- and 72-ohm impedances. Half-inch cables can handle more power and have less RF loss than the 1/4" types. Coax cables handle power best when they are operating at a 1:1 VSWR.

The table at right contains some useful information on popular coax cables. Published data (in the handbooks) on coax line loss and power handling capability all assume that the cable is operating at 1:1 VSWR. Additional line loss, and less power handling capability, occur if the cable is not operating at or near 1:1 VSWR.

The dielectric in many coax cables is foamed polyethylene. These cables are lighter, more flexible and less expensive than solid dielectric types. Although they were often disparaged when first introduced, time has shown that most of the criticism was reactionary—people do not like changes. The ends of solid or foam cables should be sealed against moisture when used outdoors. Radio Shack™ 278-1645 sealant (tape) works well.

The Velocity Factor (VF) for the cables is shown in the table. This tells how much shorter a cable should be to be equivalent to the wavelength in air. This factor is of use when making filters (typically, stubs on coax lines to reduce unwanted signals), and when making stacking harnesses to operate more than one antenna from the same feedline. There are experimental methods of determining the exact VF of a particular line, but the published data is fine for most applications.

Most ham rigs have 50-ohm input and output impedances, so it has become accepted practice to use this impedance between the various devices used in our ham shacks. In fact, since the VSWR and power loss are acceptable, 50-ohm cable is often used to feed resonant dipole antennas that have 72-ohm balanced (coax is unbalanced) impedance. Over the years, feeding balanced antennas with unbalanced coax lines has become normal practice. The 72/50 mismatch causes a VSWR of less than 1.5:1, with a short-run loss of less than 10% more than a matched line. This power loss is barely noticeable on a receiver's S-meter. A balun at the antenna may be used to help eliminate RF on the outside of the coax, consequent RF in the shack, and distortion of the antenna's radiation pattern. 73

"Foam cables were disparaged when first introduced; time has shown that most of the criticism was reactionary."

50 Ohm Types*	Velocity Factor (%)	Outside Diameter (")	Dielectric Type (**)
RG8, 8A, 213	66	0.405	
RG8X	75	0.242	Foam
RG8 Foam	80	0.405	Foam
RG58, 58A, 58C	66	0.195	
RG58 Foam	80	0.195	Foam
72 Ohm Types**			
RG11, 11A	66	0.405	
RG11 Foam	80	0.405	Foam
RG59, 59B	66	0.262	
RG59 Foam	79	0.242	Foam

**Impedances shown are nominal*

***Dielectric type is solid polyethylene unless marked "foam," in which case it is foamed polyethylene.*

Pylon Mobile Mount

A quick way to install your car rig.

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

Recently, I decided to install a new radio in my vehicle, but didn't have any under-the-dash room (which you'll understand if you own a minivan like the Plymouth Voyager). There are, however, spaces between the front bucket seats, and between the seats and the dash, that are not used. Besides all that, I wanted a way to take the radio out of the vehicle and install it quickly; with only the antenna, power and ground connections to disconnect (or connect).

The requirements have been easily and inexpensively met by using a few lengths of PVC pipe, some Tee fittings, and some elbows. The design, which can be modified to suit your own needs, is one that I think you will adopt for your own installation. It took all of an hour to cut, fit, and glue the pieces together as shown. I used the 3/4-inch o.d. material, but you can use whatever is best for your requirements. The cost was well under $10 and, best of all, the standard mobile mount bracket that comes with a transceiver is easily and quickly attached to the PVC pylon. After all pieces are cut and fitted to satisfaction, each joint is cemented with PVC cement.

The length of the single support strut may be altered to meet the desired tilt-angle of the front parallel equipment support legs. The rectangular base can be designed with an appropriate size for your vehicle, and the length and width of the front support legs can be varied to suit...*before* you glue them together. To finish off my pylon, I bought a can of spray paint to match the plush interior color of my car (burgundy).

If you want or need a VSW8 bridge to go with your radio, there is plenty of spare room on this pylon for you to mount it. One of the MFJ-900 tuners is also mounted on my pylon with the radio, tuner, and VSW8 bridge, interconnected with short pieces of RG-58/U and appropriate connectors. Disconnect the ground, antenna, and power cords, and all the gear comes out with the mounting pylon. Try it. I think you'll like it.

You'll need: 6 90° elbows, 4 Tees, 1 48-inch length of 3/4 inch o.d. PVC pipe, small tube of PVC cement, and miscellaneous hardware as needed to attach the U-shaped metal radio mounting bracket to the pylon legs. 73

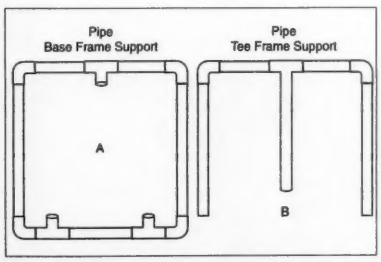

Fig. 1a. *Pre-assembled frame: pipe base frame support.*
Fig. 1b. *Pre-assembled frame: pipe Tee frame support.*

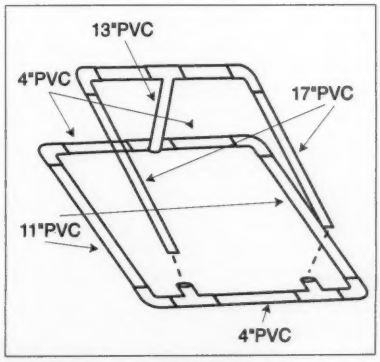

Fig. 2. *Final assembled frame.*

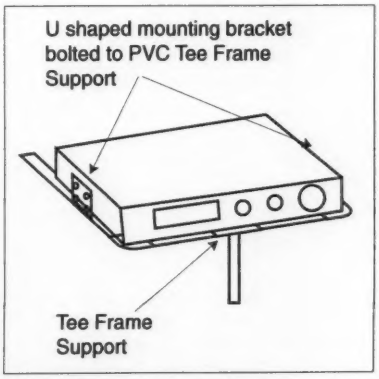

Fig. 3. *Mounting radio to frame.*

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
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Allow me a few lines to mark the passing of nineteen years of RTTY Loop. We've covered a lot of territory in two decades; from simple shift-pot FSK circuits, up through early ASCII, and now into a variety of computer modes and digital communication, this facet of amateur radio called RTTY spans a wide spectrum. It has been, and continues to be, my pleasure to bring it to you through this window I call "RTTY Loop."

Speaking of longevity, I have a note from Tom Watson WAØDJP, who professes following the column for years, being a Lifetime Subscriber to *73*. Those of you new to the magazine might ask, "Lifetime Subscriber? How much did *that* cost?"

Well, back in those days, depending on which deal you got, it cost either half of $73, that is, $36.50, or $37, that is, *73* reversed. The certificates read "Our life or yours." Don't we wish we could get that deal again!

Joe Ross AA5BD, writes: "I have been reading your column for quite a while now and enjoy it. Question: I have an old RTTY T.U. unit, made by IRL, their model 500. I was curious if you are familiar with it, and if you think the program Autort would work with it, or maybe you might suggest something else. I had the unit working many years ago on an old VIC-20—man, you should have seen those characters fly by on the screen!

"My good friend KG5CB and I worked the ARRL RTTY Round-Up a couple of weeks ago from my Dad's lake house in Jacksonville, a small town in East Texas. We used a Kenwood 450 with the Carolina Windom Antenna from Radio Works up about 50 feet in an East Texas pine tree. We had 320 contacts; we used a PK232 and had a lot of fun.

"I don't know if you are familiar with the news group RTTY List but it is fun, free, and I see some great comments and reports there. To subscribe just E-mail to:wf1b-RTTY-REQUEST@ve7tcp.ampr.org

"Put SUBSCRIBE in the subject line."

Thanks, Joe, for all the information. AUTORT, which is on the first disk of the RTTY Loop Software Collection, should work fine with a "plain vanilla" terminal unit like the IRL-500. I ran one of them several years ago, and it was a clean, solid performer. There are many other programs around, though, which will run with a plain terminal unit and computer. Take a look at the full list of what I have on the RTTY Loop Home Page, at http://www2.ari.net/ajr/rtty/ or send a self-addressed stamped envelope to the post office box above for a printed listing.

The setup for the RTTY Round-Up sounds like a winner, a basic no-frills rig that shows how easy it is to get out on digital modes. As to the news group list, I am passing it along to the readership. For those on the Internet, who don't want to get bogged down in reading one message at a time, subscribing to a news group like this can allow you to keep a finger on the digital pulse without having to go to the doctor (sorry about that!).

I received a note from Brian Vanderheyden, KBØPRY, which asked about a BASIC program for Morse code. As he wrote at the time:

"I saw in a back issue of *73* (May 1992) a BASIC program for playing random Morse code on a PC. I have a new toy...an Epson PX-8 laptop from '84, that uses CP-M and has BASIC on it. I wanted to try out the basic program that was written by Elwood Downey (WBØOEW) on the laptop (I also have a IBM-PC clone, which I am using now). Anyway, before I type all that code out, I was wondering if this file is available, say, here on AOL? I have been thinking about writing something I could use on the PX-8 and this looks like it might fit the bill."

So, I sent him a copy (digitally, of course) of the column, and he replied:

"Thanks for sending the BASIC program I asked for, along with the other two. I ran the random Morse program from my PC and it worked fine. I have ported it to the Epson portable. There are a few differences in the BASIC command syntaxes that have to be adjusted for. I got it to run up to the opening statement for selecting the source and for the lines for adjusting speed and tone, before I get an illegal function. Looks like I will have to compare some BASIC reference books and rewrite part of the code. The other two programs look interesting. I had to edit them to get them to run under QBASIC in DOS 5.0. The first program will run, and I am about halfway through the second one. Mostly putting spaces in the lines of code, and substituting some PRINT@ strings to just PRINT. I have wanted to learn how to write in BASIC (and Visual BASIC for Windows) so this little exercise will help me learn."

Sounds good, Brian. You might upgrade from DOS 5.0, though, at least to version 6.x, as there are a few new features that are worth it. I would be interested to see what you come up with, eventually. In the meantime, I will add the May 1992 column to the library of columns on the RTTY Loop Home Page, so that others can play with the code, as well.

Interest in the RTTY Loop Home Page, by the way, has been growing daily. I have received some comments that hot links to downloadable programs may not be correct. Please understand that when I link to the programs the link is correct, but that many of these programs are on other servers, producing what is often termed a "virtual library." If the other server changes the address, the link on my board will be wrong. If this happens, PLEASE let me know about it. I will either fix the link, or disconnect the link from the other server. I am also very interested to hear what you, my readers, would like to see on the page. I have tried to put up things asked for, such as the Morse program mentioned above. Drop me a line, and let me hear your thoughts.

Next month, as we begin the twentieth year of RTTY Loop, I plan to respond to many inquiries with some basic, very basic, looks at how radioteletype is encoded, transmitted, and decoded. For many of you, this may be a review; for some of you, this may be a revelation. I hope, though, that for all of you, it is interesting. In the meantime, visit the RTTY Loop Home Page at the address given above, or drop me E-mail at ajr@ari.net, MarcWA3AJR@aol.com, or 75036.2501@compuserve.com, or spend 32 cents and snail mail me at the post office box above. See you next month!

PROPAGATION

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

June is expected to provide reasonable, but not excellent, conditions for DX on the HF bands, and might provide some interesting 6 and 2 meter propagation between the 10th and 12th. Sporadic E propagation could also appear on the higher HF bands, especially around days marked "G" on the calendar.

The best days should be June 2-5, 16-19, 26 and 27, and 30. The poorest days are likely to be June 9-13 and 2-23, and the rest are expected to be fair or trending, as shown on the accompanying calendar.

Remember that thunderstorm QRN and high signal absorption due to excess daytime ionization in the Northern Hemisphere are expected during the summer months, resulting in fewer DX opportunities on the HF bands.

JUNE 1996

SUN	MON	TUE	WED	THU	FRI	SAT
						1 F
2 F-G	3 G	4 G	5 G-F	6 F	7 F	8 F
9 F-P	10 P	11 P-VP	12 P	13 P-F	14 F	15 F-G
16 G	17 G	18 G	19 G-F	20 F	21 F-P	22 P
23 P-F	24 F	25 F	26 F-G	27 G-F	28 F	29 F
30 F-G						

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40			20	15	15	15	15	
SOUTH AFRICA									15	15	15	
U.S.S.R.							20	20				
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
SOUTH AFRICA										15	15	20
U.S.S.R								20	20			

WESTERN UNITED STATES TO:

ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
SOUTH AFRICA										15	15	
U.S.S.R.									20			
EAST COAST		80	80	40	40	40	40	20	20	20		

Be alert for extremes of weather and geologic upsets on May 5 thru 7; also on May 19 and 20.

Where 10m is shown, also check 12m. Where 15m is shown, check 17m too. Where 20m is shown, be sure to look at 17 as well. Always check the bands above and below the indicated bands for possible openings to the areas shown. Remember that DX is where you find it, and not always where it is predicted to be.

10-12 meters

This is a daylight-only band this month, but may present openings to tropical areas as well as short-skip openings on the best days (G). During intense, sporadic E conditions (rare this month) bursts of strong signals can come and go unexpectedly. Stay alert.

15-17 meters

These bands could stay open into early evening hours with possibilities of trans-equatorial DX on good (G) days and evenings. Signals seem to peak toward the west during afternoon and evening hours. Short skip to 1,000 miles or so should be available on many days.

20 meters

This should be your main choice for DX-chasing. Because some areas of the world are dark and others are in daylight at the same time, you can expect dawn-to-dusk, and even later, DX opportunities on good (G) days/nights. Short-skip will prevail to about 2,000 during the day, and farther at night.

30-40 meters

You may find these bands quite noisy (QRN) during the daytime, due to the onset of thunderstorms this month, but will be quieter during the nighttime hours. DX to your east will be the best before midnight, and best to your west before dawn. Choose good (G) days for best chances of scoring a new country. Short-skip of 100-1,000 miles during the day, and 500-2,000 miles or so at night will prevail.

80 meters

You may find that 80 meters will provide DX on good (G) nights, limited by thunderstorm activity. It may also provide short-skip openings of 200 miles or so during the day and 2,000 miles or more after dark.

160 meters

There will be *no* daytime openings here, due to a high absorption of signals, but it ought to provide skip to 1,000 miles or so after dark. Only rarely will you find DX, and only on good (G) nights with low or no thunderstorm activity. Low-frequency static bursts, hundreds of miles in length, limit your spring and summer operations.

Let me know how these forecasts are working for you. W1XU 73

Continued from page 64

MORE NEW PRODUCTS

NASA Mooned America!

René, self-published, 176p, 1994 $25 plus s/h (available from Radio Bookshop). Theme of this book is that NASA never put a man on the moon; that the whole Apollo saga was just a Hollywood-like production done with the help of the CIA. My reaction on opening the book was that this is totally ridiculous. Crazy. Impossible. By the end of the first chapter I was starting to wonder if I'd sucked in on a $40 billion NASA production. By the end of the book I was convinced that, as impossible as it seems, the whole world has been suckered. If you read this book and find any fault with any of the 30 "gotcha's" I want to hear from you. For instance, the moon's surface has no moisture whatever. So why do we see boot prints where the astronauts have walked? You've walked in dry dirt and sand. It takes moisture to hold a print. When I start listing problems, every scientist I've talked to has ordered a copy of the book. Since this is not available from bookstores, and the author is understandably shy, I've arranged for Radio Bookshop to handle the book.

The Last Skeptic of Science

René, self-published, 179p, 1995, $25 plus s/h (available from Radio Bookshop). I was so impressed with the author's grasp of science that I had to get his other book. In this one René makes a very good case for Newton, Einstein, Hubble and a bunch of other scientific idols being in error. He makes a very good case for the moon not causing the tides, for the earth not being a magnet, for there never having been any ice ages, for light not having a fixed velocity, for different masses falling at different velocities in a vacuum, for there being no gravity waves...for gravity being an electrostatic attraction, and so on. The worst part is that he does a first rate job of proving his claims. You can drive scientist bonkers with this book. Worse, his arguments are in line with what I've read in the Lerner, Hoyle, and Hancock books I've recommended you read. They even are consistent with my own theories of gravity and inertia. *Wayne* 73

Cold Fusion?

It may well be one of the biggest industries in the world in a few years. The ground floor is still open for researchers, with little competition from the government, universities, or major corporations. Read all about it in *Cold Fusion*. Regularly $98 for 12 issues–Special *73* subscriber price $75. Clean energy from water at a tenth the cost of oil or coal? It sure looks that way. Send check or credit card info to Cold Fusion, 70N202, Peterborough NH 03458 or call 800 274-7373.

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← **Outgoing data appears here**

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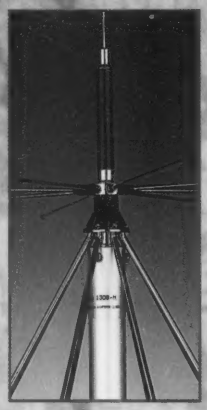
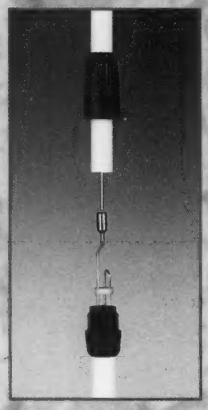
TECHNICAL DATA

Type:	VHF - UHF wide-band DISCONE
Impedance:	50 Ω
Frequency range:	Rx 25-1300 MHz
VHF Tx Band:	49-51/120-180/215-300 MHz
UHF Tx Band:	415-465/610-650/710-1000/1130-1300 MHz
Polarization:	vertical
V.S.W.R.: at freq. res.:	≤ 1.3:1
Gain:	0 dBd - 2.15 dBi
Max Power:	VHF 300 Watts ,UHF 200 Watts
Connection:	
SD 1300 U:	"UHF" female
SD 1300 N:	"N" female
Wind resistance:	40m/second
Length (approx.):	1700 mm
Base diameter:	850 mm
Weight (approx.):	1300 gr
Mounting mast:	ø 25-54 mm



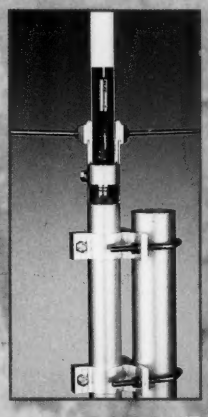


SD 1300 U/N

TECHNICAL DATA

Type:	VHF 6/8 λ UHF 3 x 5/8 λ Ground Plane
Impedance:	50 Ω
Frequency range:	VHF 142-148 MHz UHF 430-440 MHz
Polarization:	vertical
V.S.W.R. at freq. res.:	≤ 1.2:1
Bandwidth: at VSWR 2:1:	VHF 6 MHz, UHF 15 MHz
Gain:	VHF 4 dBd - 6.15 dBi UHF 6 dBd, 8.15 dBi
Max Power:	200 Watts
Connection:	"N" Female
Wind resistance:	60m/second
Length (approx.):	1800 mm
Radial length (approx):	170 mm
Weight (approx.):	950 gr
Mounting mast:	ø 35 - 54 mm

SA 270 MN



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